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Theme 1

Exercise and Active Health for Different Populations

Innovations in the Development of Strength Abilities among Schoolchild in A Special Medical Group

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Abstract Over the past 10 years, the number of chronic diseases among primary school students has increased 1.5 times. In this regard, these children are transferred to a special medical group (SMG), which adversely affects their level of physical development, including their strength abilities. To solve this problem, a special set of classes is required [2].

The health-improving orientation of physical education plays a crucial role in the physical development of students assigned to the SMG. One of the reasons for the deterioration of the health of the younger generation is that upon entering school, motor activity drops by 50% in younger schoolchildren (compared with preschoolers), and this leads to physical inactivity, which reduces the functional capabilities of the growing body [1].

The purpose of the study is to identify the impact of the developed program on the development of strength abilities, speed-strength abilities and strength endurance in primary school-age children belonging to a special medical group.

The study was conducted for 3 months on the basis of the State Educational Institution "Primary School No. 112 of Minsk" (Minsk, Uborevich str., 142). The level of development of strength abilities, speed-strength abilities, and strength endurance in the supervised children belonging to the special medical group (SMG) in both the control and

experimental groups before and after classes was determined using the following tests:

The level of development of strength abilities was assessed by us according to the tests: «Push-ups on the knees», «Lifting the torso lying down», «Throwing with the leading hand», «Throwing with the non-leading hand».

The level of strength endurance development was assessed by tests: «Hanging on bent arms», «Leg lifting lying down», «Lifting the torso».

The level of development of speed and strength abilities was determined by tests: «Squats», «Long jump», «Skipping rope».

To solve the first task of the study, we assessed the level of development of strength abilities, speed-strength abilities and strength endurance in healthy students and students of SMG. Based on the test data obtained, we found that the results of SMG students are significantly lower than their healthy peers.

When performing tests to determine the level of strength abilities, the results of students belonging to a special medical group are 20-30% lower than those of healthy students. The indicators of strength endurance were 30-50% lower, and the indicators of the level of speed and strength abilities in students belonging to the SMG group were 20-40% lower than in healthy students. This suggests that the strength abilities of SMG students require additional development.

The experiment involved 20 students aged 8-9 years. All of them were divided into healthy students and SMG students. Of these, 10 people were healthy students and 10 people were students of the SMG. Healthy students engaged in physical education twice a week for 45 minutes according to the standard program of the primary school physical education core group. SMG students engaged in physical education twice a week for 45 minutes according to the program of classes of the special medical group of the

primary school with the inclusion of elements of the program developed by us in the main part of the lesson.

The correctional and developmental program (CDP) consisted of three stages, each stage lasted 3 weeks and contained exercises of various levels of difficulty: from simple to more complex.

During the classes on the CDP developed by us, SMG students showed a significant improvement in the development of strength and speed-strength abilities, as well as strength endurance.

From the data obtained, we saw that all the indicators of SMG students improved from 20 to 50%. Analyzing the results of tests on the development of strength endurance, we obtained the following data:

When performing the «Knee Push-ups» test, the number of repetitions performed by SMG students increased by 30%, and the results of the «Trunk Lifting» test showed an increase of 29%.

When performing the «Throwing with a leading hand» and «Throwing with a non-leading hand» tests, the distance of the thrown ball thrown by the SMG students increased by 22% and 24%.

When processing the results of tests on the development of strength endurance, we received the following data:

When performing the «Hanging on bent arms» test, the time dynamics increased by 50%. When performing the tests «Leg lifting lying down» and «Trunk Lifting lying down», the number of repetitions performed by SMG students increased by 28%.

Analyzing the results of tests on the development of speed and strength abilities, we obtained the following data:

When performing the Squat test, the results increased by 18%. When performing the «Long Jump» test, the results increased by 15%, and the results of the «Jumping rope» test increased by 17%, compared with the results before the start of the study.

Conclusions. We have developed a program using exercises to develop strength abilities, strength endurance, and speed-strength abilities. As a result of the application of our proposed program, students belonging to a special medical group have statistically significantly improved their strength development. This proves the effectiveness of its effect, which makes it possible to recommend its use in physical education classes in a special medical group.

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Use of Unstable Supports for the Development of Static-Dynamic Balance in Children with Visual Impairments

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Abstract The article is devoted to the study of the methodology of using unstable supports for the development of statodynamic balance in children aged 10–11 with visual impairments. The article presents an evaluation of the effectiveness of the experimental methodology, considers the practical features of its application in correctional programs, and examines its integration with conventional approaches to adaptive physical education. The visual analyzer plays a key role in the psychophysical development of a child. Its normal functioning ensures a full perception of the world and stimulates interaction with the environment. Impaired visual functions lead to problems in cognitive development, reduced adaptability and deterioration of psychophysical condition. These disorders are often accompanied by delayed motor development, reduced physical fitness and lagging coordination skills, especially the ability to maintain balance [1].

In special schools for children with visual impairments, physical education is of particular importance, as it contributes to harmonious development, health promotion and the prevention of complications. Conducting classes in these institutions requires specific methodological approaches. According to the National Statistical Committee of the Republic of Belarus, approximately 1,500 people become visually impaired for the first time each year [2], which confirms the relevance of the problem and the need for a systematic corrective approach.

The purpose of our research is to examine the impact of the proposed methodology on the static and dynamic balance of children aged 10–11 with visual impairments. To achieve this goal, we defined the following objectives: 1. To evaluate the baseline level of static and dynamic balance in children of this age group with visual impairments. 2. To design, test, and apply a methodology aimed at the purposeful development of balance in these children. 3. To analyze the progression of balance indicators influenced by the introduced methodology.

The research was carried out in three stages. During the first stage, the study's purpose and objectives were established, followed by an analysis of scientific and methodological literature and a review of techniques for evaluating balance development. To measure static balance, the following tests were applied: the simple and complex Romberg tests, Romberg's "Swallow" test, and the "standing on toes" test. Dynamic balance was evaluated through control exercises such as jumping with a stop on a clap, walking along a gymnastic bench, jumping over an obstacle, and line walking with a turn.

At the second stage, a corrective and developmental methodology was designed and tested, focusing on improving balance in children with visual impairments through the use of unstable supports.

The third stage consisted of analyzing and assessing the dynamics of changes in balance indicators among the study group children under the influence of the implemented methodology.

The research was carried out at Special School No. 188 for Children with Visual Impairments in Minsk. A total of twelve girls aged 10–11 with different visual impairments took part and were assigned to two groups: experimental ($n=6$) and control ($n=6$). Both groups were comparable in terms of age and gender. The experiment spanned 60 days, during which adaptive physical education (APE) lessons were conducted twice a week

for 45 minutes in each group. In addition, the experimental group had additional 25-minute classes using fitballs and balancers, while the control group had classes of similar duration using special exercises to develop balance without the use of unstable supports.

The methodology relied on specialized exercises designed to develop balance, including movements from unconventional starting positions, mirror exercises, activities involving changes in speed, rhythm, and direction of motion on command, as well as their combination with rhythmic breathing.

Fitball activities included exercises such as "Balancing," "Hip Rotation," and "Walking While Sitting on a Fitball" [3]. Work on balancing devices involved maintaining posture on two legs and on one leg, as well as performing squats and push-ups.

This comprehensive approach had a positive effect on the development of balance and the overall physical condition of the children. Special exercises: balance is developed through the use of unusual starting positions, mirroring movements, changing speed and tempo on cue, and combining these with rhythmic breathing. Active games and relays: contribute to the development of balance and increased emotional tone. Examples of games include "Who's Bigger," "Walk the Path," "Step Over the Bumps," and "Carry It Without Dropping It." Exercises on equipment: develop balance by walking on a log or moving with an object on the head. Exercises on fitballs: for example, twists on a fitball and knee lifts with a fitball develop balance. Balancing exercises: balance is developed by holding static poses, squatting with posture control, holding an object on the head, standing on tiptoes, and standing on one leg.

As a result of pedagogical testing, positive dynamics in static balance indicators were recorded.

When performing the Romberg test (simple) in the experimental

group, the posture holding time increased by 31.43%, while in the control group it increased by 14.53%.

In the Romberg "Swallow" test, the holding time increased by 27.20% in children from the experimental group and by 11.16% in the control group.

The results of the Romberg test (complex, heel-to-toe) in the experimental group increased by 37.43%, while in the control group, they increased by only 9.41%.

In the toe stand test, the experimental group showed an increase of 42.63%, while the control group showed an increase of 21.82%.

A similar trend was observed in the assessment of dynamic balance:

In the "jumping with a stop on a clap" test, the results of the experimental group participants improved by 29.66%, while in the control group – by 6.98%.

When performing the "walking on a gymnastic bench" test, the test time was reduced by 27.99% in the experimental group and only by 9.86% in the control group.

The reduction in the time taken to complete the "jumping over an obstacle" test was 24.59% in the experimental group and only 7.39% in the control group.

In the "walking along a line with a turn" test, the time taken by children in the experimental group decreased by 28.40%, while in the control group, the indicator decreased by only 11.18%.

Conclusions The application of the targeted balance development methodology led to improvements in both static and dynamic balance indicators in children compared to their baseline levels. Furthermore, the progress observed in the experimental group was notably greater than in the control group. These results demonstrate that the developed methodology positively influences the balance of children with visual

impairments and proves to be more effective than the traditional program applied in specialized schools. Therefore, this methodology can be recommended as a corrective tool for enhancing balance in this category of children.

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Features of Microcirculation in Adolescent Boys Engaged in Short-Track

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Abstract The physical fitness of athletes is based on the functional capabilities of the organism [1, 2]. The work potential of muscles depends on the state of metabolic processes within the microcirculatory system. Understanding the functional capacities of the microcirculation system will allow for scientifically grounded dosing of physical exercise volumes.

The aim of the study to evaluate the level of functioning of the microcirculation system at rest and after metered aerobic exercise in adolescent male short-track athletes.

Materials and methods the study was conducted at the Smolensk State University of Sports. A total of 18 adolescent athletes aged 12 years participated in the study. Microcirculation assessment was performed using the «ЛАЗМА-СТ» laser diagnostic complex (LLC SPE «ЛАЗМА», Russia), which utilizes the principles of laser Doppler flowmetry and fluorescence spectroscopy. The probe was fixed on the distal right forearm, 5 cm proximal to the wrist joint, for a 5-minute recording period. The calculated parameters included the microcirculation index (MI), nutritive blood flow (NutBF), total fluctuation amplitude (SD), and the amplitudes of neurogenic, endothelium-dependent, myogenic, respiratory, and cardiac oscillations (all in perfusion units, PU). The athletes performed a 3-minute aerobic exercise on a cycle ergometer at 60 revolutions per minute (RPM).

Statistical data processing was performed using methods of variation statistics with Student's t-test. The analysis was conducted using the BioStat software package. The mean values (M) and the standard error of the mean (SEM) were calculated. The critical significance level (p-value) for testing statistical hypotheses in this study was set at $p<0,05$.

Results and Discussion In 12-year-old male short-track athletes, the baseline blood perfusion level in the right forearm was $4,88 \pm 0,27$ PU, which corresponds to the age-specific normative values [3]. Of the total blood volume in the microcirculatory system, 42% is redistributed to the nutritive circuit, with a nutritive blood flow (NutBF) value of $2,07 \pm 0,25$ PU. The elevated volume of blood directed to the nutritive circuit at rest is associated, on the one hand, with the processes of active growth in the 12-year-old organism. On the other hand, following systematic training loads, this mechanism facilitates the delivery of increased volumes of energy and plastic substrates to the muscles during the recovery period. A high flux value (erythrocyte oscillation) of $0,80 \pm 0,11$ PU was observed at rest. This parameter reflects the adaptability of tissue blood flow to the trophic demands of the organism [4]. The level of blood flow in the microcirculatory system is maintained by the action of intrinsic (local) and extrinsic (central) regulatory mechanisms. At rest, the contribution of intrinsic mechanisms to blood flow modulation was approximately equal, as indicated by the following oscillation amplitudes: neurogenic (An) – $0,33 \pm 0,03$ PU; myogenic (Am) – $0,29 \pm 0,03$ PU; endothelium-dependent (Ae) – $0,22 \pm 0,02$ PU. Among the extrinsic mechanisms, a predominant contribution was noted from the: cardiac component (Ac) – $0,35 \pm 0,03$ PU; respiratory component (Ad) – $0,20 \pm 0,02$ PU. For coaches and athletes, data on the energy and trophic capabilities of the microcirculatory system during training and competition are of practical interest. In this study, considering the specific demands of the sport, the young athletes

performed a 3-minute aerobic exercise test. Following the test load, perfusion in the right forearm increased by 70% to $7,0 \pm 0,74$ PU ($p<0,05$), and the nutritive blood flow (NutBF) indicator increased by 53% to $3,90 \pm 0,82$ PU ($p<0,05$). Consequently, the performed physical load volume is physiologically justified for 12-year-old athletes and can be utilized to enhance training adaptation and expand the functional capabilities of the organism. An improvement in the trophism of working organs is further indicated by a 48% increase in the flux value to $1,65 \pm 0,43$ PU ($p<0,05$). Following physical exercise, the contribution ratio of the intrinsic regulatory mechanisms changed. While neurogenic oscillations retained their maximal contribution, increasing by 115% to a peak value of $0,71 \pm 0,08$ PU ($p<0,05$) compared to rest, the contribution of the myogenic mechanism also increased by 59% to $0,46 \pm 0,05$ PU ($p<0,05$), and the endothelium-dependent mechanism increased by 55% to $0,34 \pm 0,03$ PU ($p<0,05$). We hypothesize that the increased activity of the myogenic mechanism is associated with a rise in the number of perfused capillaries, while the increased activity of the endothelium-dependent mechanism is linked to elevated blood flow velocity. This creates a flow-mediated shear stress phenomenon, triggering endothelial cells to enhance nitric oxide release into the vascular bed. Under physical load, the contribution of extrinsic (central) regulatory mechanisms increased sharply. Specifically, the amplitude of cardiac oscillations (Ac) increased 7,4-fold, and the amplitude of respiratory oscillations (Ad) increased 7,9-fold. The increased contribution of pulse waves is attributed to an elevated heart rate and the dilation of feeding arterioles within the microcirculatory system. Conversely, the enhanced contribution of respiratory waves reflects greater chest excursion (depth of breathing) and the dilation of venular vessels in the microcirculatory bed.

Conclusion 1. In 12-year-old athletes, the baseline parameters of the

blood microcirculation system correspond to age-specific norms. 2. Aerobic physical exercise modulates the active regulatory mechanisms of blood microcirculation: it stimulates neurogenic and endothelial mechanisms to increase overall blood flow, and enhances the myogenic mechanism to improve oxygen delivery and consumption by tissues. 3. The study demonstrates that the level of nutritive blood flow exhibits a targeted adaptive response to physical exercise and can be considered an informative marker for assessing an athlete's performance capacity.

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Features of Hydrokinesiotherapy and Taping Application in The Comprehensive Rehabilitation for A Fracture of the Humeral Head

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Abstract The article is devoted to the theoretical and experimental substantiation of a physical rehabilitation program incorporating hydrokin-esiotherapy and taping for middle-aged women with a fracture of the humeral head. The effectiveness of the developed methodology was assessed by analyzing the dynamics of pain syndrome, muscle strength, and range of motion in the shoulder joint.

Pathological changes of the musculoskeletal system (MSK), particularly traumatic injuries of long bones, remain a significant medical and social problem, often leading to temporary disability or even permanent disability. Among such injuries, fractures of the humerus are notably severe and carry a high risk of persistent functional impairments, accounting for up to 12.9% of all such injuries according to I.M. Ledinnikov. Nearly a third of cases of primary disability due to injuries are associated with humeral fractures. Notably, the restoration of functional capabilities after the removal of immobilization can take as long as the bone union itself [5]. As experts emphasize, "in 38.5% of victims, disability from musculoskeletal injuries is due not so much to anatomical defects as to functional impairments," which could, in principle, be prevented with well-organized physical rehabilitation.

In the context of rehabilitation measures following fractures of the humeral head, physical exercises in an aquatic environment are of exceptional

importance. Water, being significantly denser than air, modifies movement biomechanics, facilitating the performance of smooth exercises and static positions. This effect is due to Archimedes' buoyant force, which reduces gravity's effect on the body by almost 9/10 of its mass, decreasing the axial load on the joint. This feature allows for mobilization and the restoration of motor skills to begin much earlier than would be possible on land. Furthermore, water resistance can be dosed, allowing for a gradual increase in load as muscle strength and endurance recover [4].

Simultaneously, taping is occupying an increasingly significant place in the arsenal of restorative medicine. It involves the application of special adhesive bandages that provide dynamic support to the injured area. Unlike rigid immobilization, kinesiotaping aids treatment through controlled movement. This approach has four main physiological effects: reduces pain syndrome, decreases intratissue pressure, supports muscles, and corrects movement biomechanics [3].

The purpose of the study is the theoretical and experimental substantiation of a comprehensive physical rehabilitation program using hydrokinesio therapy and taping, aimed at restoring shoulder joint function in middle-aged women after a fracture.

The study was conducted at the Republican Center for Medical Rehabilitation and Balneotherapy. The observation period covered the post-immobilization stage, which began on the 21st day after surgery and lasted for 2.5 months, from May to July 2025.

Two groups of female patients were formed, with 10 individuals in each: a control group (CG) and an experimental group (EG). The average age of participants in the CG was 39.6 ± 3.1 years, and in the EG – 38.2 ± 2.4 years. The diagnosis was identical for all patients – a displaced fracture of the humeral head. Within the experiment, participants in the CG underwent a standard rehabilitation course, including therapeutic massage, therapeutic

exercises, and physiotherapy. For patients in the EG, a comprehensive physical rehabilitation program was developed and applied, which additionally included taping, hydrokinesiotherapy, breathing exercises, autogenic training, and mechanotherapy. The following research methods were used in organizing and conducting the experiment: 1. analysis of scientific and methodological literature; 2. pedagogical experiment; 3. dynamometry; 4. goniometry; 5. biomedical methods (Visual Analogue Scale (VAS)); 6. methods of mathematical statistics.

At the initial stage of rehabilitation (21st day after surgery), baseline indicators of handgrip strength and shoulder joint mobility were low in both groups and showed no statistically significant differences ($p>0.05$), confirming the homogeneity of the samples.

By the end of the rehabilitation course (after 2.5 months), a marked positive dynamic was recorded, especially in the experimental group. The pain syndrome indicator on the Visual Analogue Scale (VAS) in the EG decreased to 0.8 ± 0.2 points, while in the CG it was 2.0 ± 0.5 points ($p<0.05$).

Significant improvements were recorded regarding muscle strength. The hand dynamometry indicator in the CG reached 13.47 ± 1.03 kg, representing a 183% increase from the initial data. In the EG, this indicator increased to 23.82 ± 1.25 kg, demonstrating a 301% increase. Thus, the results of the EG surpassed those of the CG, which is statistically significant ($p<0.05$).

Analysis of the dynamics of the range of motion in the shoulder joint also showed the advantage of the comprehensive program. The restoration of mobility in the EG occurred significantly more intensively in all directions:

- Flexion: increase in CG was 113.3%, in EG – 131.7%;
- Extension: increase in CG – 71.0%, in EG – 82.6%;

- Abduction: increase in CG – 116.5%, in EG – 148.2%;
- Adduction: increase in CG – 90.1%, in EG – 123.7%.

The differences in flexion and adduction indicators between the groups were statistically significant ($p<0.05$), clearly demonstrating the effectiveness of the proposed methodology.

Fractures of the humeral head are serious intra-articular injuries that require a comprehensive rehabilitation approach to restore motor skills, muscle strength, and overall capacity for work [5]. Traditional means of physical rehabilitation, such as therapeutic exercises, massage, and physiotherapy, play a leading role in this process [1]; however, their effectiveness can be significantly enhanced through the integration of innovative techniques.

The conducted study showed that the application of the developed comprehensive program promotes more intensive stimulation of regenerative processes. The use of innovative physical means allowed for a targeted impact on the growth of the functional capabilities of the injured limb, causing their reliable and more pronounced increase in the experimental group compared to the control group.

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Testing Students' Strength Abilities in a Special Medical Group

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Abstract The article examines the downward trend in the level of strength abilities in primary school-age children belonging to a special medical group (SMG) and suffering from various diseases. In the course of the work, the most optimal tests were selected and adapted to assess the level of development of strength abilities in elementary school students belonging to the SMG group.

The relevance of this article lies in the well-chosen means and methods of physical education. Among the many tasks of the school, the education of a healthy, physically developed person who will be able to master all the program material on physical culture at a good level is a priority [1, 2].

The purpose of the work is to assess the level of development of strength abilities, speed-strength abilities and strength endurance, as well as the physical condition of younger schoolchildren involved in a special medical group using control tests.

Tests to determine the level of strength abilities are recommended to be performed regularly to determine the impact of physical education classes on the development of speed and strength qualities, strength endurance and speed and strength abilities. It is important to take into account that the assessment of children's strength abilities should be carried out taking into account their individual characteristics and level of physical fitness, as well as safety during testing.

The level of development of strength abilities in primary school-age children belonging to the SMG group was determined by the following tests:

Tests to determine STRENGTH ABILITIES

The «Push-ups on your knees» test

Purpose: to determine the strength of the flexors and extensors of the muscles of the arms and shoulder girdle.

Methodology: the subject is in I.P. – in a kneeling position. Then bend your arms at the elbow joints to an angle of about 90°, bringing your torso closer to the floor. The body should form a straight line, and the abdominal muscles should be tense at all times. Return to I.P. by straightening your arms. The test runs for 1 minute.

The «Throwing the ball with the leading hand» test

Purpose: to determine the strength of the right and left hands.

Methodology: the subject stands exactly in line, legs apart. Then he holds the ball with his leading hand, bringing it to his ear and simultaneously turning his torso towards the leading hand. Perform a U-turn and simultaneously push the ball out.

The «Throwing a ball with a non-leading hand» test

Purpose: determination of the strength of the right and left hands.

Methodology: the subject stands exactly in line, legs apart. Then he holds the ball with his non-leading hand, bringing it to his ear and simultaneously turning his torso towards the non-leading hand. Perform a U-turn and simultaneously push the ball out.

Tests to determine STRENGTH ENDURANCE

The «Leg lifting lying down» test

Purpose: determination of the strength endurance of the abdominal muscles.

Methodology: the subject is in I.P. – lying on his back, arms along the

trunk. Then, at the teacher's command, the subject needs to raise his straight legs (~ 25 cm from the floor) and return to the I.P. The test is performed for 1 minute.

The «Lifting the torso» Test

Purpose: determination of the strength endurance of the abdominal muscles.

Methodology: the subject is in I.P. – lying on his back, legs bent at an angle of 90 ° at the hip and knee joints, feet completely touching the floor, hands behind his head. Then you need to lift your torso to a sitting position, touching your elbows to your knees and return to the starting position. The test runs for 1 minute.

Tests to determine SPEED and STRENGTH QUALITIES

The «Squat» Test

Purpose: determination of the speed and strength abilities of the leg muscles.

Methodology: the subject is in I.P. – standing, feet shoulder-width apart, arms in front of chest. Bending the legs at the knees, lower the pelvis down to a position where the hips are parallel to the floor, while the body position does not change. Then, stretching your legs, return to the I.P. The test is performed for 1 minute.

The «Long Jump» test

Purpose: determination of the speed and strength abilities of the muscles of the legs and abs.

Methodology: the subject needs to stand on the starting line, push off with two feet, making an intense swing with his hands, and perform a jump. When landing, the result is fixed on the heels. The subject is given 2 attempts; the best one is fixed.

To make sure that the SMG students studied differ in their physical abilities and level of development of strength, speed and strength abilities

and strength endurance from their healthy peers, control tests were conducted.

After analyzing the obtained data on the parameters of the development of strength abilities, strength endurance and speed-strength abilities in the studied and healthy students before the start of the research, we found out that there are statistically significant differences between the results of all control tests in SMG students and healthy students. Based on this, it can be concluded that the strength abilities of healthy students are better developed.

Conclusions. These tests make it possible to assess the physical development and functional capabilities of students in a special medical group with various diseases.

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Features of the Development of Physical Abilities in Young Biathletes with Flat Feet

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Abstract The study is aimed at identifying the features of the development of physical abilities, static and dynamic balance, speed abilities and endurance in adolescent biathletes with flat feet, compared with their healthy peers.

The urgency of the problem lies in the fact that nowadays health is considered an important condition for achieving and developing a person's physical success. Modern sports are characterized by intense physical exertion and place special demands on the condition of the musculoskeletal system. The study of this issue is especially relevant in children's sports, since injuries and diseases of the musculoskeletal system are one of the main reasons for premature termination of training and competitive activities [1, 2].

The training process in biathlon is accompanied by a large vertical load on the foot, a decrease in the cushioning properties of the foot, a redistribution of the load, and an increase in the contractility of the ligamentous-muscular apparatus of the lower extremities. As a result, biathletes have flat feet. In this regard, athletes need to create optimal conditions for the development of physical abilities and correction of flat feet.

Based on the above data, it can be said that the use of correctional and preventive measures in the structure of sports training has a high pedagogical value and can prolong a person's time in sports, however, the

implementation of these measures is possible only if reliable information about the features of deviations is available. Today, flat feet are one of the most common diseases and occur in 50% of the population. Almost every modern person falls into the risk group.

The aim of the study was to study the peculiarities of the development of physical abilities in adolescent biathletes with flat feet and their healthy peers.

The study was conducted for 3 months on the basis of the biathlon complex of the Specialized Children's and Youth School of the Olympic Reserve in Gomel (Republic of Belarus). 24 subjects participated in the experiment.

In the course of the study, we conducted a comparative pedagogical experiment aimed at determining the effect of physical therapy classes on the correction of flat feet in biathletes aged 12-14 years. In the experiment, two groups were compared: the control group (engaged in a training program developed by the trainer) and the experimental group (performed a set of exercises aimed at correcting flat feet at the beginning of the lesson).

To study the effect of flat feet on training activities in biathletes aged 12-14 years, both in the control and experimental groups, before and after the training cycle, we used tests to determine static-dynamic balance, speed-strength qualities and endurance.

The results of the study and their discussion. There are statistically significant differences between the results of these control tests in biathletes with flat feet and their healthy peers. It is possible to see a lag due to the low level of development of static equilibrium in biathletes with flat feet.

All tests of biathletes with flat feet were statistically significantly lower than those of healthy biathletes, which proves that healthy athletes

are better developed.

If we analyze the data obtained, it becomes obvious that there are statistically significant differences between the results of all control tests. At the same time, the parameters of dynamic balance development are higher in healthy biathletes than the results of biathletes with flat feet.

The test results clearly confirm that statistically significant differences were found between the results of dynamic equilibrium tests in the studied groups. Thus, it can be concluded that healthy biathletes have a better dynamic balance.

The indicators indicate the presence of statistically significant pronounced differences between the indicators of the level of development of speed abilities in biathletes with flat feet and their healthy peers before the start of the study. The test results of healthy biathletes are significantly better than those of biathletes with flat feet.

After analyzing the data obtained, there is a significant lag in the level of speed development among biathletes with flat feet compared to the results of healthy biathletes.

There are statistically significant differences between the results of all control tests in the studied groups. At the same time, there is a significant lag in the development of endurance in biathletes with flat feet from the results of healthy biathletes. Thus, it can be concluded that healthy biathletes have better endurance.

Biathletes with flat feet show lower results than healthy biathletes. These data show that biathletes with flat feet have 7-14% lower results than their healthy biathletes and need further development.

Conclusions The results obtained represent the data obtained from the results of all control tests. They unequivocally and statistically reliably prove that healthy biathletes have significantly better physical development than biathletes with flat feet. Adolescent biathletes with flat feet have a

lower level of physical ability development than healthy biathletes, which affects their overall health and athletic performance.

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On the Question of the Health of Students of the Technological University

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Abstract This article presents an analysis of the health status of first-year students in all faculties of the Belarusian State Technological University (BSTU) based on medical certificates from the 2020/2021 to 2024/2025 academic years.

Introduction In the Republic of Belarus, the issue of maintaining student health has become extremely important and is addressed at all levels of the educational system. Particular attention is paid to this issue when working with students with health problems. Health depends largely on the organization of the educational process and students' independent work [2].

The problem of student health has in recent years consistently attracted the close attention of scientists, medical specialists and teachers, which is caused by the high level of illness among students and the widespread prevalence of factors that have a negative impact on their health [1].

Lack of knowledge of the basics of a healthy lifestyle and the unwillingness to lead an active lifestyle, strengthen the immune system through hardening and regular physical activity, lead to a high incidence of disease among young people [3].

The aim of the study is to analyze the health status of first-year students of all faculties of BSTU based on the analysis of medical certificates from the 2020/2021 to 2024/2025 academic years.

Materials and methods. The following methods were used in this study: 1) analysis of scientific and methodological literature; 2)

pedagogical observation; 3) analysis of medical certificates from the 2020/2021 to 2024/2025 academic years; 4) analysis and generalization of the results of the pedagogical research.

BSTU has seven faculties that offer Physical Education courses: FIT – Faculty of Information Technology; FOST – Faculty of Organic Substances Technology; FCET – Faculty of Chemical Engineering and Technology; FEE – Faculty of Engineering and Economics; FPTMC – Faculty of Printing Technologies and Media Communications (Publishing and Printing); FF – Faculty of Forestry; FFEMSD – Faculty of Forest Engineering, Materials Science and Design.

Results of the study. The number of first-year students of BSTU from the 2020/2021 to 2024/2025 academic years (7137 people) assigned to the following medical groups for classes in the academic discipline "Physical Education" is presented: 1) main medical group (MMG); 2) preparatory medical group (PMG); 3) special medical group (SMG); 4) therapeutic physical education (TPE) classes in the clinic; 5) exempted from classes (EFC) in the academic discipline "Physical Education".

In September of the 2020/2021 academic year, a total of 1,542 students began attending Physical Education classes. The students were distributed among medical groups as follows: 559 in the MMG, 688 in the PMG, 273 in the SMG. 19 students attended physical therapy classes at the clinics. Three more students were exempt from practical classes and took a theoretical exam in this subject.

In the 2021/2022 academic year, 1,385 students began classes. Of these, 510 were in the MMG, 639 in the PMG, 213 in the SMG, 17 in the TPE, and six students were exempt from physical education practical classes.

In the 2022/2023 academic year, 1,436 students began classes. Of these, 518 were in the MMG, 610 in the PMG, 271 in the SMG, 23 in the TPE,

and 14 were exempted.

In the 2023/2024 academic year, the total number of students was 1,355. Of these, 508 were in the MMG, 607 in the PMG, 219 in the SMG, 16 in the TPE, and 5 were exempt.

In the 2024/2025 academic year, 1,419 students attended classes. Of these, 571 were in the MMG, 610 in the PMG, 196 in the SMG, 30 in the TPE, and 12 were exempt.

Every year, BSTU records an increase in the number of students referred to the PMG for medical reasons. The significant number of students referred to the SMG for health reasons also remains unchanged year after year. An analysis of the number of students enrolled in the SMG at BSTU over the past five years reveals fluctuating trends, ranging from 230 to 300 annually. The composition of the SMG student body varies across departments, ranging from 20 to 70, depending on the total number of first-year students enrolled in a particular department. More than a third of students require a differentiated approach to determining physical activity, taking into account their medical diagnosis.

Conclusions Due to the increasing number of students with health issues, the use of physical education for health promotion is becoming increasingly important. These measures are designed to create optimal conditions for normalizing physiological functions, as well as promote overall physical fitness and health improvement in students. To achieve maximum effectiveness in physical education for students, new, more effective models and approaches to organizing training are needed. This includes identifying opportunities to improve the skills of future professionals and optimizing their preparation for subsequent employment.

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Trauma Factors in Child and Youth Sports and Prevention Measures

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Abstract The article examines the main factors of injuries in children's and youth sports and possible prevention measures. The study aimed to identify and systematize the internal and external causes of sports injuries in young athletes through theoretical analysis of domestic and foreign literature. The main risk factors were found to include the mismatch between training loads and age capabilities, insufficient physical fitness, methodological errors, and emotional instability. Key preventive directions involve individualization of the training process, development of general physical fitness, regular medical monitoring, and formation of a culture of safe behavior.

In recent decades, interest in youth sports has significantly increased due to both health-improvement goals and early sports specialization. However, the growing number of participants has led to a rise in injury rates, which has become a serious issue in athlete development. Studies show that 20–40 % of injuries among children and adolescents are related to sports activities [1, 3].

Sports injuries limit physical activity and may cause long-term consequences such as musculoskeletal disorders, decreased motivation, and early dropout from sports. Therefore, studying injury factors and developing prevention strategies are key tasks for sports pedagogy and medicine [2].

The causes of injuries are multifactorial and can be divided into endogenous – internal (age-related anatomical features, ligament weakness, insufficient fitness, psycho-emotional stress) and exogenous –

external (coaching mistakes, overloads, poor equipment, unfavorable training conditions) [3].

Injury types depend on the sport. Team games often lead to sprains and bruises, gymnastics to joint and spinal injuries, and martial arts to bruises and fractures [1]. This highlights the need to consider sport-specific features in prevention planning.

Foreign research shows that systematic prevention programs reduce injuries by up to 30 % [4]. Effective approaches include coordination and stabilization training, as well as education for coaches and parents on safe training and overload prevention.

Injury prevention should be comprehensive, combining pedagogical, medical, and organizational measures. A key priority is the individualization of the training process, considering age, gender, fitness, and health status [3]. Copying adult training models or focusing solely on performance is unacceptable.

Another important aspect is the development of general physical fitness, which increases resistance to stress and reduces injury risk [1]. Regular medical control ensures timely load adjustments and detection of health deviations [2].

Pedagogical work should focus on correct technique, gradual progression, and age-appropriate exercises [3]. It is equally essential to form a safety culture among young athletes – understanding warm-up, recovery, discipline, and self-control [2].

Parents play a crucial role in ensuring safe participation by monitoring health and cooperating with coaches and medical staff.

The analysis shows that youth sports injuries result from a combination of biological, pedagogical, organizational, and psychological factors [1–3]. The most vulnerable group includes children with low physical fitness, excessive training loads, and insufficient supervision [3].

Reducing injury rates requires a systemic approach that integrates individualized training, fitness development, medical support, improved coaching methods, and a safety-oriented mindset. Implementing these measures will enhance training efficiency and preserve the health of young athletes.

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The Possibilities of Using an Individual Integrated Methodology to Increase the Motor Activity of Disabled People with Musculoskeletal Disorders in Cyclical Sports

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Abstract The article presents a methodology for conducting educational and training sessions on an individually integrated program for increasing motor activity for disabled people with musculoskeletal disorders in cyclical sports. The applied program for increasing the motor activity of disabled people was developed by us as a single six-month cycle and consisted of three mesocycles.

The main pedagogical experiment involved a group of six individuals with disabilities and pathological deviations in the functions of the musculoskeletal system (MS) functions. The research was conducted over six months and consisted of training sessions based on a comprehensive program. The Wilcoxon signed-rank test was used to determine the significance of the data within the groups.

The criterion for evaluating the effectiveness of our methodological approaches was the asymmetry of the subjects' motor actions, assessed by changes in the asymmetry coefficient.

Materials and Methods: the first phase of the experimental program included training regimens combining exercises in both artificially created and typical training environments. As subjects mastered rational

movements, the percentage of use of exercise equipment and technical aids decreased [1].

This included: Water-based exercises, incorporating general developmental exercises in and out of water. Acquisition of swimming techniques using a "adjustable safety device." Walking and running on a treadmill research stand equipped with a "lightweight suspension" system and a forced motion device enabling regulated pace and speed of walking movements. Walking and running in natural conditions using "elastic energy recuperators" attached to various parts of the lower extremities.

Running training at optimal and maximum speeds for each subject.

The first phase had a rehabilitative character.

The second phase involved a transition from rehabilitation to increased physical activity and focused on competitive training. The main objective of this phase was to determine the possibilities of competitive activity for individuals with musculoskeletal system (MS) disabilities [1, 2].

The training sessions with individuals with disabilities were conducted at the sports facility of Penza State University, Penza.

The six-month pedagogical experiment began with the introductory mesocycle, lasting one and a half months. The main objectives of this mesocycle were: Preparing the musculoskeletal system for walking and running; Improving the level of functional fitness.

Means General developmental exercises on land and in water, various walking variations, specific running exercises, and basic swimming exercises.

The pool training program included various walking and running movements in the shallow end of the pool, combined with basic swimming exercises: gliding on the chest and back, opening eyes underwater, exhaling underwater, and sets of general developmental

exercises, taking into account water resistance. The dosage of strength and cyclical exercises was selected according to individual fitness levels.

The program of water-based training sessions in the first part of the developmental mesocycle included general developmental exercises on land and in water, various walking variations in the shallow end of the pool, and basic general developmental exercises performed in combination with gliding on the back and chest. Then, gliding tasks were given under "adjustable safety" conditions. Arm and leg movements were practiced alternately, first standing still in the water (front crawl, backstroke), then using the trainer. After mastering individual movements, coordinated leg movements with breathing, arm movements with breathing, and coordinated arm and leg movements with breathing were taught. In the second part of the developmental mesocycle, walking regimens on the treadmill were used more extensively, where the asymmetry coefficient for each subject was minimized, i.e., smoothing of the asymmetry of movements of the left and right legs was observed. The speed of movement was selected individually for each individual with a disability.

Results in the first stage of the main pedagogical experiment, at the end of the introductory mesocycle, testing was conducted to determine functional indicators, joint mobility, flexibility, and general physical fitness. However, comparing the results in mobility and flexibility tests with the results of general physical fitness tests, the former show a more significant increase, reaching up to 60% in some participants. Our pedagogical experiment lasted six months and consisted of introductory, developmental, and competitive mesocycles. The experiment involved individuals with disabilities who had varying degrees of illness and different deviations in musculoskeletal system functions. The subjects had different levels of physical fitness. Not all subjects could perform the

same physical exercises. This was primarily due to the characteristics of their illnesses [1, 2, 3].

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The Interaction of Physical and Aesthetic Education in the Primary School System

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Abstract The article focuses on the physical and aesthetic education interaction in the primary school system, which ensures the versatility, harmony and integrity of school students' personal development based on musical and rhythmic activities.

The problem of accumulation of human capital, which generates high intellectual potential based on a high level of health in all its aspects: physical, spiritual and moral, is acute in modern conditions of society and the state development. The solution of this problem requires the increase of the scale of regular physical education and sports, which draws attention to the study of the theoretical and methodological foundations of the interaction of physical and aesthetic education in the primary school system and creates prerequisites for the harmonious development of the school students' personality with established positive mindset and motives for regular physical education and sports.

The scientific research and publications analysis shows that a number of researchers have paid attention to the harmonious spiritual, physical and moral development of students, among them Chinese authors Wang Xing, Tian Ye, Wang Qing, Li Guopin, Zhang Weiwei (2007), who position physical education as an important element of the personality harmonious development. Great importance is given to popular national gymnastics (Gorbatenko T.B., Prokofieva L.K., Sharenkova T.A., 2019. [4]. This problem was in the field of the International Congress attention among scientists of the Republic of Belarus [5]. The research of V.I. Stolyarov [3],

L.D. Nazarenko, J.A. Ignatieva [1], T.T. Roters [2] and others should be also pointed out.

It has been established that physical education has a specific content, which includes a variety of physical exercises that fill school students with specific “kinesthetic cues”, provide knowledge about spatial, temporal, spatiotemporal, dynamic and rhythmic characteristics of physical exercises performed, ideas about their variable performance depending on emerging motor tasks and unexpected situations.

The main mechanism of interaction is the motor musical and rhythmic activity based on the means of rhythmic gymnastics. The dominant component of interaction is the development of motor rhythm and musical rhythm in the elementary school students' personality.

Motor rhythm is developed because of the formation of students' complex perception and reproduction of a sense of time, a sense of space, a sense of muscle effort precision, which makes it possible to reproduce the direction of movement, speed, acceleration, frequency and other movement characteristics precisely. The main means of developing motor rhythm is a special training in the reproduction of rhythmic formulas-drawings, which stimulates students to secure movement control skills based on a rational alternation of loads and rest, tension and relaxation, and as a result – the movement and working efficiency. The study found that high-level athletes (masters of sports) have a high sense of rhythm based on the reproduction of rhythmic formulas, and school students who play sports have significantly higher indicators compared to those who do not play sports. Therefore, there is a consistent correlation between the level of the motor rhythm development and the athlete's ability to master correct and rational technique, as well as to control the motor act with the refinement of spatial and temporal relations.

The main means of interaction between physical and aesthetic

education in our study is music, where the main means of expression are sound, tempo, timbre, rhythm.

The interaction of gymnastic exercises and their musical accompaniment have different patterns. For example, emotional rhythmic music encourages students to move, where movements convey the artistic image of a piece of music in structure and form. These can be various dance exercises, exercises with objects, jumps, turns, rhythmic gymnastics exercises and other musical and rhythmic courses. Therefore, the musical rhythm is closely connected to the motor rhythm. The music motor perception is most characteristic of elementary school students, which contributes to the development of auditory-motor coordination of movements. That is why it is most beneficial to engage in complex coordination sports at primary school age. Note that the musical rhythm perception is always an auditory-motor and emotional process.

In conclusion, we note that the results of the study are theoretical and methodological in nature and serve as the basis for modeling the interaction process between physical and aesthetic education of school students in the primary school system, which involves the construction of various means of interaction, to which we have attributed different variants of rhythmic formulas, musical and rhythmic games, musical accompaniment of the main types of physical exercises, free plastics exercises.

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A Healthy Lifestyle for Youth Is a Priority for the Nation's Sustainable Development

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Abstract The state is doing everything necessary to preserve the health of its citizens. As Head of State Alexander Lukashenko rightly noted: *“The health of the nation is the concern of each of us. Without physical activity and sports, there will be no healthy children, people, or a healthy nation as a whole.”*

A healthy lifestyle is a concept of human activity aimed at improving and maintaining health through appropriate nutrition, physical fitness, mental attitude, and the elimination of harmful habits. The relevance of a healthy lifestyle is driven by the increasing and changing nature of stress on the human body due to the increasing complexity of social life and the increasing risks of man-made, environmental, psychological, political, and military factors, which provoke negative shifts in health. Therefore, fostering this lifestyle among young people is a crucial social task of national importance [3].

Relevance The primary step in this context is to identify the perceptions and views of young people at BSUOR regarding a healthy lifestyle in the modern world, with the goal of subsequently adjusting them and identifying the latest opinions and attitudes regarding health and a healthy lifestyle. Nowadays, caring for a person's physical well-being is

becoming increasingly important.

The goal of this work is to develop students' health-related knowledge and engage them in practical and research activities as a way to understand themselves and the world around them. **Healthy lifestyle** is the only lifestyle capable of restoring, maintaining, and improving the nation's health. Developing this attitude among young people is a crucial social task of national importance.

At the Bobruisk State Olympic Reserve School, attention is paid to fostering a healthy lifestyle and safe living, instilling in students a caring and conscious attitude toward health. Teachers and coaches, through personal example, help young people develop healthy lifestyle stereotypes. The development of a healthy lifestyle culture in students is directly linked to their professional education. One component of a healthy lifestyle is systematic physical education and sports. Students in the departments are encouraged to promote a healthy lifestyle during physical education classes and outside of school hours through sports and mass sports events at the school, as well as participation in city, national, and international events.

In our research, we worked primarily in the following areas: ensuring sanitary and hygienic requirements for the organization of the educational process and psychological, medical and social support for students at each stage of their development; implementing ongoing diagnostics and correction of children's health; conducting activities to develop a healthy lifestyle for schoolchildren; introducing methods and technologies of health-preserving , health-forming , and health-promoting content adapted to the specific conditions of the educational institution; involving all participants in the educational process in activities that preserve and develop health [2].

To consolidate the results obtained, we relied on the following types of projects:

A research project. It had a clearly defined structure: topical relevance; problem, subject, and object of the study; goal, hypothesis, and objectives; research methods; discussion of implications; conclusions and recommendations. An example of a research project was a survey (Why do people become addicted to drugs, alcohol, and cigarettes? How does physical activity affect the human body?) [2].

The information and educational project aimed to gather information from high school students about the impact of various factors on human health and to share this information with various groups (peers, younger students, teachers, and school staff). The primary goal of the information project was to increase students' competence in a specific aspect of the problem [4].

The Bobruisk State Olympic Reserve School conducts regular and systematic medical checkups for students. This is done to assess their health and prevent the spread of diseases at an early stage. The goal of the checkups is to promptly detect asymptomatic illnesses that are hidden from parents. The earlier a pathology is detected, the higher the chances of curing or correcting it.

As a result of pedagogical collaboration, basic rules for a daily routine for our athletes have been developed: An athlete should begin each day with a short warm-up/exercise, choosing exercises that most effectively prepare the muscles for exercise after a complete rest. It is recommended to include elements or exercises required at a specific stage of training. It is preferable to warm up outdoors, regardless of the season. After the warm-up, it's time for water treatments: showering, dousing, or rubbing down. Meals should be eaten at the same time every day; this ensures proper digestive function and has a beneficial effect on performance.

During intense training, it's essential to prioritize sleep and rest. A

full eight hours of sleep ensures adequate rest and the ability to continue intense training. Avoid alcohol, smoking, and excessive amounts of sweet and fatty foods. Smoking and alcohol should be avoided by athletes who want to achieve progress during training. Maintaining a hydration regimen is just as important as proper nutrition. A nutritionist develops a daily diet for athletes, taking into account the athlete's sport, goals, and objectives. We have developed a balanced nutrition system that allows athletes to maintain excellent physical fitness, actively train, and rest.

Conclusions One of the main goals of our pedagogical experiment was to develop students' health-promoting and health-preserving competencies, which consist of possessing specialized valeological knowledge, developing life skills and healthy lifestyle habits, and fostering a conscious attitude toward their own health and its maintenance. The above approaches do not fully address this issue, necessitating further research in this area.

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Overview of the General Health Status of Adults in Belarus and China (2018–2023)

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Abstract This article is devoted to a comparative review of statistical data on population health indicators of Belarus and China for 2018–2023. These data need to be analyzed to identify which problems should be addressed with physical culture first.

In recent years, the health of the adult population of Belarus and China has been assessed according to key indicators: life expectancy, self-rated health, morbidity and disability levels. Both countries are affected by population ageing and the rise of non-communicable diseases (NCDs). In Belarus, life expectancy increased until 2019 but then decreased, while in China this figure continues to rise smoothly.

Life expectancy in the Republic of Belarus rose to 74.8 years before 2019, but then fell to 73.1 by 2021 [1]. In the People's Republic of China, there is no decline in life expectancy: it rose to 77.3 years in 2019 and reached 77.6 years by 2021.

The gap between countries remains significant – the Chinese population, on average, lives longer (about 77–78 years) compared to Belarusian (about 72–74 years). In both countries there is a gender imbalance: for example, in Belarus in 2021, men lived on average 67.3 years. Women – about 78 (Belstat data) – which reflects the high mortality rate of middle-aged men (due to causes such as suicides, alcohol-related diseases, etc.). These figures correlate with the high rate of deaths from NCDs in both countries.

The burden of non-communicable diseases is predominant in all countries analysed. In Belarus, according to WHO estimates, NCDs remain the main cause of morbidity, disability and premature death among adults. According to data for 2021, NCDs accounted for 75 % of all deaths in Belarus [2]. In China, the proportion is even higher – about 91 % of deaths in 2021 are NCD-related [3]. Infectious diseases (including COVID-19) in Belarus accounted for 16% of deaths, in China – only 3 % [3, 4]. The proportion of deaths from non-communicable injuries (accidents, poisoning, suicides, etc.) in Belarus is about 4 %, in China – 6 %.

Both countries report an increase in the incidence of chronic illness and adult disability. For example, in Belarus the first national «STEPS» survey on NIH (2016) confirmed the wide prevalence of risk factors (smoking, hypertension, etc.) and disease progression [3]. In China, the growth of NCDs is similarly related to urbanization and aging; the acute problem is the overcrowding of the public health system for patients with multiple chronic diseases [4].

NCDs dominate: they cause 75 % of deaths in Belarus and 91 % – in China [3, 4]. Communicable diseases and COVID-19 in Belarus accounted for 21 % of deaths (16% + 5%), in China – only 3 % (COVID was not singled out). The proportion of deaths from injuries (accidents, falls, etc.) is relatively low.

Over the past five years, the overall health status of adults in Belarus has deteriorated compared to the previous period. This can be seen in the reduction of life expectancy (after 2019) and high mortality from NCDs. In China, overall health remains better and more stable: life expectancy continues to rise, the proportion of deaths from infections is low, but the burden of chronic diseases is also huge (as everywhere with an aging population).

Thus, general trends show: in Belarus after 2020 there was a decline in life expectancy, and the burden of NCDs remains very high; in China, life expectancy remains high with a gradual increase, with almost all deaths from NCDs (including cardiovascular disease, cancer, etc.). The growing burden of chronic diseases and disability in both countries is clearly visible.

These findings show that in both countries it is very important to increase the attention of the state to tackle NCD prevention through the promotion of physical culture and mass sports.

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A Study on the Influence of Urban Football League Culture on Adolescents' Health Behavior

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Abstract Objective With the acceleration of China's urbanization process and the in-depth advancement of the national fitness strategy, urban football leagues, as an important carrier for the integration of mass sports and urban culture, have been exerting an increasingly prominent influence on the youth group. Adolescence is a crucial stage for the development of healthy behaviors. The elements embodied in urban football leagues, such as the competitive spirit, team culture, and sense of community belonging, are permeating into the daily lives of young people through diverse pathways, exerting a potential and far-reaching impact on their physical and mental health development. However, the current academic research on the specific connections, mechanism of action, and practical value between the culture of urban football leagues and the healthy behaviors of adolescents remains insufficient.

Methods Literature review method, interview method, observation method, questionnaire survey method, and data statistics and analysis method.

Results (1) The impact of team collaboration culture on adolescents' healthy behaviors. There is a positive correlation between team collaboration culture and adolescents' physical exercise as well as mental health. (2) The impact of rule-awareness culture on adolescents' healthy behaviors. Rule-awareness culture mainly affects adolescents' regular work and rest patterns and eating habits. Adolescents with a strong sense of rules are better able to abide by their schedules, as they have developed the habit of following rules in leagues and transferred this habit to their

daily lives. (3) The impact of striving and progressive culture on adolescents' healthy behaviors. Striving and progressive culture has a positive impact on adolescents' physical exercise. The spirit of striving and forging ahead motivates adolescents to continuously challenge themselves, increase the intensity and duration of exercise, and thereby improve their sports performance. (4) The impact of sportsmanship culture on adolescents' healthy behaviors. Sportsmanship culture mainly affects adolescents' mental health and social adaptability. Concepts in sportsmanship such as respect, tolerance, and fair competition help adolescents form correct values, enhance their emotional regulation abilities, and strengthen their social adaptability. Adolescents with good sportsmanship are better able to maintain a positive attitude when facing setbacks and difficulties, resulting in better mental health.

Conclusions (1) The effect of promoting adolescents' physical health is significant. The culture of urban football leagues has a direct impact on improving adolescents' physical fitness through building a transmission chain of "infrastructure - event participation - health indicators". (2) Dual improvement of mental health and social adaptability. The league culture shapes adolescents' social-emotional abilities through team collaboration mechanisms. (3) Cultural reconstruction of gender equality awareness. The league culture is breaking through the shackles of traditional gender roles. (4) Community penetration effect of healthy behaviors. The atmosphere of "activities every day and competitions every week" formed by the leagues extends healthy behaviors from the sports field to daily life.

Suggestions (1) Construct a stepped event supply system. Increase the number of adolescent urban league events. (2) Strengthen the cultural cultivation of gender equality. Increase the proportion of close-up shots of women in event broadcasts, and reconstruct adolescents' perception of gender roles through media narratives. (3) Establish a diversified

collaborative governance mechanism. Promote coordination among the government, society and families in a unified manner.

Keywords: Football league culture; Adolescents; Healthy lifestyle

Innovative Research on Elementary School Physical Training Methods Based on the SPARK Curriculum Concept

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Abstract Research Purpose The physical fitness of students in China has consistently been a significant concern for both schools and society. This study utilizes literature review and experimental methods to design innovative physical training methods for elementary school students based on the SPARK curriculum concept. Firstly, guided by the principles of fun, intensity, persistence, variation, measures, and implementation rooted in the SPARK curriculum concept, a theoretical foundation for designing physical training methods is established. Secondly, based on the requirements of physical training and considering the psychological and physical developmental characteristics of students at different grade levels, a series of fun physical training games are designed chronologically. These games primarily target the development of strength, speed, flexibility, coordination, agility, and endurance in students of various ages. Thirdly, these physical training games progress from simple to complex and from easy to difficult, allowing students to gradually adapt, experience enjoyment, build confidence, and ultimately achieve the goal of improving their physical fitness.

Research Findings 1. The content of the physical training games was designed based on the age and physical/psychological characteristics of students at different levels, including games focused on developing strength, speed, flexibility, coordination, agility, and endurance. 2. The design of the physical training games progresses from bodyweight exercises to using equipment, and from individual activities to team-based ones, thereby increasing the fun and practicality of the training. 3. Students

were grouped appropriately according to their physical conditions and age characteristics, and the duration and intensity of the games were controlled to make the physical training more scientific and reasonable.

4.Teachers provided active guidance and established scientific evaluation and incentive mechanisms to fully mobilize student enthusiasm and participation interest, effectively integrating education with entertainment.

Conclusion After establishing the innovative model for elementary school physical training methods based on the SPARK curriculum concept, practical application during routine physical education classes demonstrated a tangible improvement in students' initiative towards physical exercise. This model achieved comprehensive enhancement of students' physical fitness and holds positive guiding significance and practical value for elementary school physical training and physical education teaching.

Keywords: SPARK curriculum concept; elementary school; physical training methods; innovation

Exercise Rehabilitation for Populations with Chronic Diseases: Integration of Domestic and International Research Progress, Application of Cutting-edge Technologies, and Practical Pathways

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Abstract Objective With the global continuous rise in the incidence of chronic diseases such as hypertension, diabetes, coronary heart disease, exercise rehabilitation as a core means of non-pharmacological intervention has attracted significant attention regarding its clinical value and implementation effectiveness. However, current domestic and international research on exercise rehabilitation for populations with chronic diseases faces issues including fragmented research outcomes, lack of standardization in intervention protocols, unclear differentiation of rehabilitation pathways for different disease types, and insufficient exploration of the application potential of emerging technologies such as wearable devices and artificial intelligence guidance systems in rehabilitation. This study aims to systematically integrate the core achievements and research frontiers in the field of exercise rehabilitation for populations with chronic diseases at home and abroad over the past 10 years, clarify the mechanism of action, appropriate protocols, and implementation bottlenecks of exercise rehabilitation for different chronic diseases, and provide theoretical support and practical reference for constructing a scientific, efficient, and universal exercise rehabilitation system for populations with chronic diseases, thereby promoting the standardized application of exercise rehabilitation in chronic disease

management.

Methods This study adopted a combination of systematic review and Meta-analysis, and conducted research in strict accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses PRISMA guidelines. Databases searched included core domestic and international databases such as PubMed, Web of Science, Cochrane Library, China National Knowledge Infrastructure CNKI, and Wanfang Data. The search period was limited from January 2015 to January 2025, with search keywords including chronic diseases, exercise rehabilitation, hypertension, diabetes, coronary heart disease, intervention protocols, wearable devices, etc. Through two rounds of independent screening initial screening of titles and abstracts, secondary screening of full texts, literatures that did not meet the inclusion criteria such as non-original research, sample size < 50 subjects, unclear intervention measures were excluded. Finally, 218 valid literatures were included including 89 Chinese literatures and 129 English literatures. Information such as the research type, research objects, exercise rehabilitation protocols exercise type, intensity, frequency, duration, and outcome indicators physiological indicators, quality of life scores, incidence of adverse events of the included literatures was extracted. RevMan 5.4 software was used for Meta-analysis, and sensitivity analysis and subgroup analysis were conducted to verify the stability of the results.

Results and Analysis (1) Comparison of Domestic and International Research Achievements International research is more mature in the design of personalized protocols for exercise rehabilitation of populations with chronic diseases such as adjustment of exercise intensity based on genotyping and long-term follow-up management with an average follow-up of 3-5 years, and the proportion of multi-center clinical trials reaches 62%. Domestic research focuses on the promotion of

community-level rehabilitation models with a community participation rate of 78%, but the proportion of personalized protocols is only 35%, and the missing rate of long-term follow-up data is relatively high about 40%.

(2) Mechanism of Action and Effect of Exercise Rehabilitation The results of Meta-analysis showed that for hypertensive patients, moderate-intensity aerobic exercise such as brisk walking, swimming, 150 minutes per week could reduce systolic blood pressure by an average of 8.2 mmHg and diastolic blood pressure by 5.1 mmHg $P < 0.01$. Meanwhile, for patients with type 2 diabetes, resistance exercise such as dumbbell training, 2-3 times per week combined with aerobic exercise could reduce glycated hemoglobin Glycated Hemoglobin A1c, HbA1c by 0.65% $P < 0.01$. For patients after coronary heart disease surgery, structured cardiac rehabilitation exercise such as progressive walking training could reduce the re-admission rate by 23% $P < 0.05$. Additionally, exercise rehabilitation could also significantly improve the mental health status of populations with chronic diseases, with anxiety scores reduced by an average of 4.3 points and depression scores reduced by 3.8 points $P < 0.01$.

(3) Research Frontiers and Technology Applications The current research frontier focuses on precision exercise rehabilitation. For example, wearable devices are used to monitor heart rate and exercise load in real time, and artificial intelligence Artificial Intelligence, AI algorithms are combined to dynamically adjust rehabilitation protocols. Such research has entered the clinical verification stage abroad with an effective rate of 85%, while domestic research is still dominated by basic research, with a clinical conversion rate of less than 20%. At the same time, the demand for remote exercise rehabilitation guidance has surged after the epidemic. Both domestic and international studies have shown that it can improve patient compliance compliance rate increased to 65%-70%, but in China, there are problems such as low popularity of equipment community

coverage rate is only 30% and insufficient professional guidance personnel.

Conclusions and Recommendations (1) Research Conclusions 1. Exercise rehabilitation has a clear effect on improving the physiological indicators, enhancing the quality of life, and preventing adverse events of populations with chronic diseases, and it is an important part of the comprehensive management of chronic diseases. 2. Domestic and international research on exercise rehabilitation for populations with chronic diseases has different focuses, but both have common problems such as lack of standardized protocols, insufficient long-term follow-up, and lagging clinical conversion of cutting-edge technologies. Moreover, there is a certain gap between domestic and international research in the design of personalized protocols and technology application. 3. Precision exercise rehabilitation and remote rehabilitation guidance are the core development directions in the future, and the integration of wearable devices and AI technology will provide key support for the optimization of rehabilitation protocols. (2) Practical Recommendations 1. Policy Level: The state should accelerate the formulation of the Diagnostic and Therapeutic Norms for Exercise Rehabilitation of Populations with Chronic Diseases, clarify the standards of rehabilitation protocols for different diseases, and include exercise rehabilitation in the scope of medical insurance reimbursement for chronic diseases to improve patients' enthusiasm for participation. At the same time, increase investment in community rehabilitation equipment, and achieve a coverage rate of more than 60% for community wearable rehabilitation monitoring equipment by 2025. 2. Research Level: Domestic research needs to strengthen multi-center and long-term follow-up clinical trials, focus on breaking through the clinical conversion of personalized protocol design and cutting-edge technologies such as AI guidance systems, and it is

recommended to establish a domestic and international research cooperation platform to share data and achievements. International research can learn from Chinas community rehabilitation model to improve the grass-roots popularization of exercise rehabilitation. 3. Clinical Practice Level: Medical institutions should establish a multi-disciplinary team for exercise rehabilitation covering doctors, rehabilitation therapists, and dietitians to formulate personalized protocols for patients. At the same time, strengthen health education for patients to improve their awareness and compliance with exercise rehabilitation, with the goal of increasing the long-term compliance rate of patients to more than 75%.

Keywords: Chronic Non-communicable Diseases; Exercise Rehabilitation; Intervention Protocol; Precision Exercise Rehabilitation; Wearable Devices; Artificial Intelligence; Remote Rehabilitation Guidance; Long-term Follow-up; Multi-center Clinical Trial

A Study on the Influence of Short Video Dissemination of Female Sports Culture on Proactive Health Behaviour Among Young Women

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Abstract Research Objective The influence of short videos on sports culture dissemination is increasingly evident, with female-centric sports content proliferating daily. Driven by policies such as "Healthy China 2030", proactive health behaviours among young women in China are gradually evolving. The "National Fitness Programme" emphasises popularising fitness culture, promoting sporting spirit, and inspiring nationwide fitness initiatives. This study explores how female-centric sports culture in short videos influences young women's proactive health behaviours, aiming to deepen the dissemination of sports culture, enhance women's health awareness, and support the health initiative. It analyses the connotations, types, and characteristics of female sports culture dissemination in short videos, investigates its impact on young women's proactive health behaviours, and seeks to better leverage the positive guiding role of such dissemination in shaping young women's health practices.

Research Methods (1) Literature Review Method: Keywords including "female sports culture" "short videos" and "proactive health behaviours" were used to retrieve relevant literature and materials from platforms such as China National Knowledge Infrastructure (CNKI). (2) Quantitative statistical analysis: Using Douyin and Kuaishou as representative short video platforms, quantify the volume and influence of female-centric content and creators; (3) Case study analysis: Examine

leading sports content creators and viral videos as exemplars to assess their impact on young women's proactive health behaviours; (4) Logical analysis: Synthesize the typology of sports-themed content creators and material, summarise their connotations and characteristics, and evaluate their influence across multiple dimensions.

Results and Analysis Female sports culture within short videos refers to sports-related content disseminated primarily by female creators and targeting female audiences, encompassing sports ideologies and behavioral techniques. On the two major platforms, female-centric sports culture videos primarily fall into four categories: image presentation, group exercise instruction, knowledge sharing, and motivational content. Analysis of representative cases reveals the following characteristics and impacts of female-centric sports culture dissemination via short videos: (1) Popularization of sports knowledge, primarily through training method sharing, enhances young Chinese women's sports literacy and healthy behavioral norms; (2) Transformation of role identities through the domestication of elite athletes' lifestyles, fostering positive shifts in young women's self-perception and strengthening proactive health awareness; (3) Reconstructing social values by challenging traditional notions, dismantling the constraints of conventional sports thinking among young Chinese women; (4) Innovating business models with the primary goal of optimizing sports services, providing material support for proactive health behaviors among young Chinese women.

Conclusions and Recommendations Sports culture dissemination in short videos, with women as the primary subjects, influences young women's proactive health awareness and behaviour through knowledge sharing, image identification, value reconstruction, and commercial services. Recommendations: Continue leveraging short videos' strengths in sports culture dissemination. Platforms should provide traffic support

for high-quality content and creators, ensuring "trending content gains maximum visibility." Relevant creators should deepen video content development, enhance production quality, and promote sound sports cultural values. China's young women should courageously break free from "information silos," independently select video content, and proactively strengthen health awareness and behaviors.

Keywords: Female Sports Culture; Proactive Health Behaviors; Short Video; Dissemination of culture

The Impact of Tabata Training on the Health-related Physical Fitness of Fifth and Sixth Grade Students

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Abstract Research objective Currently, there is a lack of an appropriate training method to effectively improve the decline in students' physical fitness. This study aims to conduct a comparative analysis to determine whether Tabata training can replace or further enhance traditional physical education teaching methods and have a positive impact on health-related physical fitness.

Research Method Experimental method. The training load was set to reach 70% - 85% of the maximum heart rate. The training time and conditions only changed in recreational activities, with two 10-minute Tabata training sessions added to ensure the teaching content was compact and reasonable. The specific test indicators are as follows: body composition; cardiorespiratory fitness; muscular fitness; flexibility fitness. Mathematical statistics method was used to conduct a comparative analysis between the experimental group and the control group, with $P < 0.05$ being statistically significant.

Research results and analysis (1) Before the experiment, there was no significant difference between the two groups. After the experiment, there was a very significant difference in body composition statistically ($p < 0.01$). (2) Before and after the experiment, both the experimental group and the control group showed significant differences ($p < 0.01$). (3) According to the comparison between the experimental group and the control group before and after the experiment, significant differences were found ($p < 0.01$). (4) According to the comparison between the experimental group and the control group before and after the experiment,

the P values were 0.08 and 0.16 respectively ($p < 0.05$), indicating a certain degree of significant difference.

Research Conclusions and Suggestions (1) Tabata training has a certain positive impact on body composition. (2) It has a significant effect on enhancing the cardiorespiratory fitness of adolescents. (3) It can improve the ability to maintain continuous exercise and increase muscle fitness. (4) It is more beneficial for attracting students' participation, but the improvement in flexibility is relatively lacking.

Keywords: Health-related fitness; High-intensity interval training; Tabata training

Research on the Influence of Functional Training on the Speed Quality of Soft Softball Players in Primary Schools

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Objective With the vigorous development of physical education in primary schools, soft baseball and softball has become a favorite sport for primary school students because of its strong interest, high teamwork requirements and good safety. As one of the most important physical qualities in soft baseball and softball, speed quality has a direct influence on the performance of athletes in running base, catching and passing the ball and defending movement. Functional training emphasizes the action mode as the core, and improves the athletes' comprehensive physical ability by simulating actual sports scenes. The purpose of this study is to analyze the actual effect of functional training applied to the speed quality training of primary school soft baseball and softball players, and to clarify the advantages and differences of functional training in improving the speed quality of athletes compared with traditional training methods. Provide a more targeted and effective training program for the speed quality training of primary school soft baseball and softball players.

Methods This study adopts various research methods such as literature review, experiment, mathematical statistics and comparative analysis. Forty primary school softball players were selected as the research objects and randomly divided into experimental group and control group, with 30 students in each group. The experimental group adopts a functional training scheme, and the training content focuses on improving the movement mode and physical function related to soft baseball and softball, such as fast changing direction, multi-directional jumping, resistance running training, etc., and training twice a week, with

each training lasting 40 minutes for 8 weeks; The control group used traditional speed quality training methods, including conventional sprinting and skipping, and the training time and frequency were the same as those of the experimental group. Before and after the experiment, the two groups of athletes were tested for the speed quality of soft baseball and softball, including 30-meter sprint, pitching speed, passing speed, swinging speed, base sliding speed, T-test and light reaction time. Using SPSS27.0 tool, through independent sample T-test, this paper compares the data differences between the two groups before and after the experiment, and judges the influence of functional training on the speed quality of primary school soft baseball and softball players.

Results After eight weeks of functional physical training, the data of 60 subjects before and after the experiment were integrated and analyzed, and it was found that the test results after the training showed that the experimental group had significantly improved seven indexes of the speed quality of soft baseball and softball (30-meter sprint, pitching speed, passing speed, swinging speed, base sliding speed, T-test and light reaction time) ($P < 0.05$); After 8 weeks of traditional physical training, only the scores of 30-meter sprint and T-test in the control group were significantly improved ($P < 0.05$), while the other five indexes such as throwing speed and passing speed were not significantly improved ($P > 0.05$). The experimental results show that the improvement of speed quality in the experimental group after training is significantly higher than that in the control group in all dimensions. This data fully proves that functional physical training has more outstanding advantages and practical value in enhancing the speed quality of soft baseball and softball students.

Conclusions 1. The function of functional training to improve reaction speed: The multi-directional movement and fast direction-changing exercises in functional training simulate the complex

situation faced by primary and secondary school athletes in soft baseball and softball competition, which can effectively stimulate the athletes' nervous system, improve nerve conduction speed and reaction sensitivity, and enable athletes to respond to incoming balls and teammates' signals more quickly in the competition, thus improving reaction speed. 2. The influence of functional training on enhancing movement speed: Through targeted jumping training, resistance running training, etc., functional training can enhance the muscle strength and explosive force of athletes' lower limbs, improve the coordination of muscle contraction and relaxation, and enable athletes to swing and displace their limbs faster in running the base, catching the ball and passing the ball, and improve the movement speed. 3. Advantages of functional training in improving displacement speed: Functional training pays attention to the coordinated work of all parts of the body and the optimization of the overall action mode, so that athletes can use their physical strength more reasonably during running, reduce energy loss, improve energy conversion efficiency, and thus improve displacement speed. In contrast, the traditional training method is relatively simple, and the comprehensive improvement effect on physical function is limited.

Advice 1. In the speed quality training of primary school softball players, it is suggested to combine functional training with traditional training methods, give full play to their advantages and make a more scientific and reasonable training plan. 2. Coaches should flexibly adjust the functional training scheme according to the individual differences of athletes, such as physical fitness and sports foundation, so as to ensure the pertinence and effectiveness of training. 3. Further strengthen the research on the application of functional training in soft baseball and softball in primary schools, explore more functional training methods and means suitable for the characteristics of primary school students, and provide

more powerful support for the development of soft baseball and softball in primary schools.

Effects of Long-Term Endurance Exercise on Improving Exercise Capacity and Related Metabolic Functions in Mice by Regulating Gut Microbiota

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Abstract Objective To systematically explore the regulatory effects of long-term endurance exercise on gut microbiota, exercise capacity, and metabolic functions in mice, and to clarify the mediating role of gut microbiota in the regulation of exercise capacity.

Methods A total of 52 5-week-old SPF-grade male C57BL/6 mice were randomly divided into four groups: control group (Group C, n=15), long-term endurance exercise group (Group E, n=15), PBS transplantation group (Group PT, n=11), and fecal microbiota transplantation group (Group MT, n=11). Mice in Group E received 14 weeks of moderate-intensity treadmill exercise. After constructing gut decontamination models via intestinal cleansing with antibiotics and compound polyethylene glycol, mice in Group PT and Group MT were transplanted with PBS and fecal microbiota suspension from Group E mice, respectively (0.2 mL per dose, twice a day for 7 consecutive days). The associative mechanism among exercise, microbiota, and exercise capacity was revealed through exhaustive exercise tests, detection of blood glucose and glycogen reserves, determination of antioxidant indexes

in the liver and muscles, and analysis of the composition and function of gut microbiota using 16S rRNA sequencing.

Results 1) Long-term endurance exercise significantly improved metabolic functions and antioxidant capacity in mice: The contents of liver glycogen and muscle glycogen in Group E were significantly higher than those in Group C ($P<0.05$); the liver malondialdehyde (MDA) content in Group E was significantly lower than that in Group C ($P<0.05$); the superoxide dismutase (SOD) activities in the liver and gastrocnemius muscle of Group E were significantly higher than those in Group C ($P<0.01$, $P<0.05$). 2) Exercise significantly reshaped the gut microbiota structure: The abundances of *Bacteroides*, *Parabacteroides*, and *Odoribacter* in Group E were significantly lower than those in the sedentary group ($P<0.05$); furthermore, the abundances of *Parabacteroides* and *Odoribacter* were extremely significantly negatively correlated with liver/muscle glycogen ($P<0.01$) and significantly positively correlated with SOD activity ($P<0.05$), while the abundance of *Bacteroides* was significantly negatively correlated with SOD activity ($P<0.05$). 3) Fecal microbiota transplantation could partially transfer the exercise-induced microbiota effects: After transplantation, the abundance of Firmicutes at the phylum level and Alpha diversity in Group MT were significantly higher than those in Group PT ($P<0.01$, $P<0.01$), and the abundance of Bacteroidetes was significantly lower than that in Group PT ($P<0.05$); there were 12 differential genera between the two groups—Group MT was enriched with 8 beneficial bacteria (e.g., *Bifidobacterium*, *Ruminococcus*) and inhibited 2 harmful bacteria (e.g., *Parabacteroides*, *Sutterella*) ($P<0.05$); in addition, there were 40 KEGG metabolic pathways with significant differences (e.g., flavonoid biosynthesis, propionate metabolism) ($P<0.05$). 4) After transplantation, the exhaustive exercise capacity of Group MT was significantly higher

than that of Group PT ($P<0.05$) but lower than that of Group E ($P<0.01$); core genera (e.g., *Ruminococcus*, *Clostridium*) were significantly positively correlated with exercise capacity ($P<0.05$), while harmful genera (e.g., *Parabacteroides*, *Sutterella*) were significantly negatively correlated with exercise capacity ($P<0.01$).

Conclusions Fourteen weeks of moderate-intensity long-term endurance exercise can improve metabolic functions in mice by enhancing glycogen reserves and antioxidant capacity, while directionally regulating the composition and function of gut microbiota. The gut microbiota induced by exercise can be transferred to recipient mice via fecal microbiota transplantation, reshaping their microbiota structure and improving their exercise capacity—this confirms that gut microbiota is an important mediator in the regulation of exercise capacity. This study provides experimental evidence for the "exercise-microbiota-metabolism" interaction mechanism and offers a theoretical basis for the subsequent development of "exercise + microbiota" combined intervention strategies to improve exercise capacity and prevent metabolic disorders.

Keyword: long-term endurance exercise; gut microbiota; exercise capacity; metabolism

Research on Differentiated Strategies of Exercise Intervention and Active Health Promotion for Different Populations

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Abstract The concept of active health advocates maintaining health through proactive lifestyle interventions. As its core implementation means, exercise shows remarkable differences in health-enhancing effects for various populations. This study aims to systematically analyze the correlation mechanisms between exercise and active health among six major groups, namely adolescents, the elderly, people with chronic diseases, children with special needs, high-level competitive athletes, and practitioners in special industries, and to deeply explore the core points, implementation principles, and specific methods of exercise intervention for each group.

This study uses the literature-research method to sort out the theoretical achievements and practical experiences in the field of exercise and health for different populations at home and abroad, resorts to the case - analysis method to select representative exercise-intervention projects for various groups (such as the sunshine sports curriculum for adolescents, the community sports classes for the elderly, the hospital rehabilitation programs for people with chronic diseases, etc.), and combines the interdisciplinary-analysis method, integrating theories from multiple disciplines such as exercise science, medicine, and sociology to conduct the research.

The research results and analysis show that: for adolescents, participating in exercise can promote physical growth and development,

enhance cardiopulmonary function, and also have a positive impact on psychological development. The intervention should be guided by interest-stimulation, focus on all-around development, and strengthen the cooperation among schools, families, and society. The "Sunshine Sports" practice in a certain middle school has reduced the obesity rate of students by 12% and increased the excellent rate of cardiopulmonary function tests by 20%; the exercise of the elderly is aimed at delaying the decline of physical functions and preventing chronic diseases, and it is necessary to follow the principles of safety, mildness, individuality, and emphasis on social interaction. The "Silver - Age Sports Class" in the community has reduced the fall risk of participating elderly people by 30% and significantly improved their self - care ability; the exercise rehabilitation of people with chronic diseases must be carried out under the supervision of medical professionals, adopting phased and personalized programs and combining comprehensive management measures in many aspects. The "exercise-nutrition" combined intervention for diabetes in a certain hospital has reduced the average glycated hemoglobin of patients by 1.5%; the exercise rehabilitation of children with special needs is helpful to improve their physical functions and social skills, adopting gamified and personalized intervention models, while encouraging family participation and social integration. The project of a certain special - children's rehabilitation center has increased the independent walking ability of children with cerebral palsy by 50%; the exercise intervention for high-level athletes focus on special-event physical-fitness training, sports-injury prevention, and long-term health management. The intelligent training system constructed by a certain professional basketball team has reduced the sports-injury rate of players by 40%; the exercise intervention for special - industry personnel revolve around improving professional ability and ensuring operational safety, carrying out training

under simulated professional scenarios and extreme conditions. The practical-combat training system introduced by a certain fire - fighting detachment has increased the operational efficiency of firefighters by 25% and decreased the work - injury incidence by 20%.

In conclusion, the correlation between exercise and active health for different populations has population - specific characteristics. In the future, it is necessary to rely on interdisciplinary integration and technological innovation to develop personalized and precise exercise-health management programs, and to build an exercise - health service system that covers all populations and runs through the entire life cycle. At the same time, it is necessary to strengthen the cooperation among disciplines such as exercise science, medicine, and education to provide more targeted exercise-health support for various populations and help the in - depth promotion of the Healthy China strategy.

Keywords : Differentiated Exercise Intervention; Exercise Mechanism of Active Health; Precise Exercise-Health Management; Exercise Health in the Whole Life Cycle.

Age-Friendly Transformation of Sports Spaces in Urban Villages of Guangzhou: An Institution–Life Co-Construction Perspective

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Abstract Objective Under the dual background of China's rapid urbanization and population aging, urban villages, as an important spatial type in urban renewal, accommodate the living and housing needs of a large elderly population. Existing studies on the age-friendly adaptation of sports spaces mainly focus on formal communities, while limited attention has been paid to sports spaces in urban villages—spaces situated between urban and rural contexts. From the perspective of the “institution–life” co-construction framework, this study takes three types of urban villages undergoing transformation in Guangzhou as examples, linking macro-level institutional arrangements with micro-level residents' everyday lives. By analyzing the two key subjects of sports activities - “people” and “space”—the study seeks to answer the following questions: What are the sports needs of elderly residents in urban villages? What are the characteristics of sports spaces in urban villages? And to what extent do these spatial characteristics align with the elderly population's needs for physical activity? The ultimate goal is to construct an optimization pathway for sports spaces that better serve the elderly.

Methods The research first adopts a literature review method to systematically analyze national and Guangzhou-level policies on sports development, the “10-Minute Fitness Circle” initiative, and other related plans, clarifying the institutional mechanisms influencing the age-friendly adaptation of sports spaces in urban villages. Field investigations are then

conducted through on-site observations, facility documentation, and accessibility analysis to obtain data on the distribution patterns, facility conditions, and age-friendly levels of sports spaces. Based on different stages of urban village transformation, three representative cases are selected for comparative analysis to examine the similarities and differences in spatial layout and age-friendliness, revealing the interactive logic between institutional provision and residents' everyday practices. Subsequently, questionnaires were distributed to 200 elderly residents aged 60 and above to assess their exercise frequency, activity preferences, space choices, and satisfaction levels. In-depth interviews with 20 typical respondents were also conducted to identify challenges encountered in their daily exercise routines and their adaptive coping strategies.

Results The study yields several key findings. First, there exists a problem of insufficient and fragmented spatial supply. Although Guangzhou has made progress in promoting national fitness and age-friendly policies, urban villages remain constrained by unclear land ownership and limited public financial support, leading to a shortage and uneven distribution of sports facilities. Second, residents' sports demands are strong and diverse. Survey results indicate that elderly residents prefer low-intensity, socially engaging, and culturally integrated physical activities. They prioritize the proximity and safety of sports spaces over mere quantity or scale. Third, the age-friendliness of facilities requires urgent improvement. Existing sports spaces still lack adequate barrier-free design, safety features, and suitable exercise options for older adults, resulting in a notable gap between elderly users' actual experiences and their health needs.

Conclusions In summary, the age-friendly adaptation of sports spaces in Guangzhou's urban villages exhibits a pattern characterized by "institutional lag—life-based compensation—interactive reconstruction."

Future optimization should focus on three key directions: (1) promoting targeted policy and resource allocation to improve both the quantity and quality of sports facilities in urban villages; (2) enhancing age-friendly design by emphasizing accessibility, safety, and social interaction; and (3) encouraging community co-construction and co-governance to integrate residents lived experiences with institutional innovation. These strategies can provide practical insights for addressing population aging and advancing the development of healthy cities.

Keywords: Urban villages; Age-friendly design; Sports space; Institution–life co-construction; Urban renewal

Practical Dilemmas and Improvement Pathways of Anti-Doping Education Literacy in Provincial Sports Teams from the Perspective of Health Promotion: An Empirical Study Based on Henan Cycling Team

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Abstract Objective This study adopts the perspective of "health culture promotion" and focuses on the Henan cycling team to explore the practical challenges faced by provincial sports teams in anti-doping education. It aims to propose strategies for deepening anti-doping efforts from the standpoint of health promotion and sports culture construction, fostering athletes' value recognition and behavioral consciousness of "winning clean gold medals," and promoting the healthy, pure, and sustainable development of sports.

Methods A questionnaire survey was conducted among athletes of the Henan cycling team, utilizing standardized questionnaires developed by the China Anti-Doping Agency and self-designed "anti-doping quizzes." The questionnaire covered seven dimensions, including doping control procedures, whereabouts reporting, prevention of three types of substances (food, supplements, and medications), therapeutic use exemptions, sports spirit, and the anti-doping framework. It comprised 110 questions, with 10 randomly selected for testing. A total of 45 valid questionnaires were collected and analyzed using SPSS 25.0 and Excel 2019.

Results The results indicate that athletes generally performed well in foundational anti-doping knowledge, with an average score of 6.89 (SD =

1.837) and a left-skewed distribution concentrated in the mid-range scores. However, significant deficiencies were observed in health risk cognition and cultural consciousness: athletes showed limited understanding of whereabouts reporting details such as "recommended testing time," with accuracy rates as low as 0%–62.5%, reflecting vague cognition of daily health monitoring. Their knowledge of legal liabilities and health consequences related to anti-doping rule violations was insufficient, particularly regarding relevant clauses in *the Criminal Law*, with an accuracy rate of 0%. While their grasp of prevention knowledge for the three types of substances was relatively better, certain cognitive gaps remained, with some questions scoring only 50% accuracy. Additionally, athletes demonstrated inadequate understanding of inspection procedure details closely related to health monitoring, such as urine specific gravity and DBS, as well as insufficient knowledge of advanced topics like therapeutic use exemptions application processes. Weak cognition was also observed regarding the international context and cultural values of the anti-doping governance system. These issues highlight the current shortcomings of anti-doping education in terms of content depth, cultural immersion, and practical relevance from the perspectives of health education and sports culture.

Conclusion To advance anti-doping education from "knowledge transmission" to "health consciousness and cultural internalization," the following recommendations are proposed: First, establish a health-oriented anti-doping education system: Integrate anti-doping knowledge into health risk education and sports ethics education through problem- and scenario-driven approaches, enhancing athletes' awareness of self-protection in health. Second, implement a "knowledge-culture" double-helix teaching model: Embed thematic chains such as "sports spirit" and "legal culture" into the traditional knowledge chain,

systematizing anti-doping education and elevating its cultural significance. Third, expand participatory and experiential educational pathways: Promote the integration of online and offline teaching methods, leveraging digital platforms to enhance interactive experiences and inspire athletes' transition from "passive acceptance" to "active construction," thereby ensuring that anti-doping education is deeply understood, internalized, and translated into action. Future research should further focus on "integrating anti-doping with health promotion pathways" and "the empowering mechanisms of sports culture in anti-doping education," with the aim of constructing a health-oriented sports education system with Chinese characteristics.

Keywords: Anti-Doping; Provincial Sports Teams; Health Culture Promotion; Cycling

Application Research of Wearable Sensors in Human Movement Analysis during the Competitive Training of Wushu Routine Athletes

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Abstract Objective Wushu routine is a highly competitive sport that requires extremely high standards of movement standardization, stability, and artistic expressiveness. Traditional training methods rely on coaches' subjective observations and have limitations such as being difficult to quantify and unable to accurately capture the details of high-speed and complex movements. With the development of wearable sensor technology, it has shown significant advantages in sports monitoring, biomechanical analysis, and training personalization. This study systematically explores the current application status and development trends of wearable sensor technology in Wushu routine training, focusing on analyzing its value in aspects such as training load quantification, technical movement analysis, real-time feedback, and injury prevention, in order to provide theoretical reference and practical guidance for the scientific application of this technology. **Methods:** Through literature research and logical analysis methods, relevant studies in databases such as CNKI and Web of Science were retrieved and analyzed to summarize the application achievements and existing problems of wearable sensor technology in Wushu training, and to construct the theoretical framework and research viewpoints of this paper.

Results First, the sensor system based on inertial measurement units (IMUs) can accurately quantify the training load, and can accurately monitor external load indicators such as acceleration and angular velocity

and internal load parameters such as heart rate variability during the process of athletes completing difficult movements (such as consecutive tornado kicks, spinning body rotations, etc.). Through data analysis and processing, coaches can formulate personalized training plans based on this to ensure the scientific nature and pertinence of the training load. Second, the system integrating IMU and ultra-wideband (UWB) technology can achieve biomechanical modeling and intelligent diagnosis of key technical movements. Through three-dimensional motion capture and algorithm analysis, the standardization of technical movements can be objectively evaluated, such as the verticality of the rotation axis and landing stability. Finally, by continuously monitoring indicators such as training intensity and muscle status, a scientific injury risk warning model has been established, providing an effective means for preventing sports injuries and overtraining. However, this technology still faces many challenges in practical applications: in terms of technical performance, the battery life of the sensor is limited, and the measurement accuracy is easily affected by environmental interference and motion noise; in terms of data processing, the fusion and analysis of multi-modal data take a long time, making it difficult to achieve instant feedback, and data interpretation requires interdisciplinary professional knowledge; in terms of device wearing, the volume and position of the sensor may affect the technical performance and movement performance of athletes; in terms of promotion, the high system cost and maintenance expenses limit its large-scale application in Wushu projects.

Conclusion This study found that wearable sensor technology can be effectively applied to Wushu routine training, transforming traditional subjective and empirical training into data-based objective and scientific training, and demonstrating great application potential in aspects such as technical movement optimization, exercise load monitoring, sports injury

prevention, and the formulation of personalized training programs. This research provides a new methodology and practical tool for the scientific training of Wushu routine projects, and has important theoretical and practical significance for promoting the modern transformation of the competitive Wushu training model in China.

A Study on the Influencing Factors of Primary School Female Teachers' Participation in Sports Activities—Based on a Narrative Study of 4 Teachers

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Abstract Primary and secondary school teachers often bear the dual pressures of professional work and family responsibilities. A healthy body is the foundation for teachers' life and work, and participating in physical exercise is one of the most efficient and simplest ways to maintain health. As the backbone of primary and secondary schools at the grassroots level, understanding the influencing factors of primary school female teachers' participation in physical exercise is conducive to improving the physical and mental health of primary and secondary school teachers, promoting the development of primary and secondary education, and actively driving the transformation of their concepts. It can enhance their awareness of the importance of sports activities, arouse their enthusiasm for participation, and provide real experiences as valuable references for the future development of the teacher group. This paper adopts qualitative research to study the participation of female teachers in a primary school in Lianjiang City in physical exercise, so as to identify the influencing factors and countermeasures of primary school female teachers' participation in sports activities. Using the literature review method and educational narrative method, this paper studies the influencing factors of physical exercise of 4 primary school female teachers in Lianjiang City, and draws the following conclusions: The 4 primary school female teachers have a good lifestyle of physical exercise, with clear and definite sports cognition, but lack professional technical guidance. The 4 primary

school female teachers have certain problems in sports learning, and some of them encounter sports difficulties during exercise. The 4 female teachers have clear exercise motivations, mainly choose aerobic exercises, and express their pursuit of health needs and weight loss/body shaping.

The main factors affecting the 4 primary school female teachers' physical exercise include cognition, motivation, leisure time, sports atmosphere, and venue facilities. Affected by work and family, the 4 female teachers have insufficient leisure time and cannot maintain a stable time for physical exercise. The sports atmosphere plays a positive role, which can well improve the 4 female teachers' enthusiasm for physical exercise. Venues and equipment restrict the 4 female teachers' participation in physical exercise, and the female teachers are not inclined to invest in physical exercise, which thus limits their choice of sports programs.

Therefore, the following countermeasures to solve the influencing factors of sports activities are put forward: Advocate the society and education departments to pay attention to the physical and mental health of primary school female teachers; Integrate resources, increase investment in sports facilities, venues and equipment, and create good sports venues and equipment for female teachers to actively participate in physical exercise; Strengthen the publicity of physical exercise and carry out scientific exercise popularization; Improve primary school female teachers' awareness and cognition of physical exercise, help them understand the relationship between physical exercise and health, learn sports knowledge through multiple channels, take the initiative to understand sports, improve their physical exercise ability, and clearly recognize the importance of physical exercise in terms of cognition.

Evaluating the Health Benefits of Short Bouts of Physical Activity for Adolescents: Pathways for Integration in the School Environment

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Abstract Objective The physical and mental health of adolescents is a cornerstone of national talent development and societal progress. Currently, due to significant academic pressure, the time available for structured physical activity among Chinese adolescents has been severely compressed. Consequently, "short bouts of physical activity" (e.g., 10-minute activities during class breaks, 5-8 minutes exercises during commutes) have become their primary form of daily exercise. However, there is a lack of quantitative assessment of the health benefits of such activities in academic literature, and pathways for their integration within the school environment remain unexplored. This study aims to quantitatively evaluate the tangible benefits of adolescents' short bouts of physical activity on their physical fitness and mental health through empirical analysis. Concurrently, it seeks to explore specific pathways for the effective integration of these activities within the school setting, thereby providing data-driven support and practical solutions to alleviate insufficient physical activity and improve the health outcomes of adolescents.

Methods This research employed a three-pronged methodological approach, combining literature review, surveys, and experimental investigation. First, the literature review method: A comprehensive search of databases such as CNKI and Web of Science was conducted, yielding 96 relevant articles on "adolescent short bouts of physical activity" and

"school-based physical activity integration" to establish the current research landscape and theoretical framework. Second, the questionnaire survey method: A survey was administered to 1,200 students from four middle schools (two junior high and two senior high). A total of 1,086 valid questionnaires were collected (a response rate of 90.5%), investigating the time distribution, activity choices, participation frequency, and barriers related to short bouts of physical activity. Third, the experimental method: A total of 240 students from six second-grade junior high classes were selected as subjects. They were randomly divided into an experimental group (n=120), which engaged in three daily sessions of 6-8 minute short-bout exercises (including rope skipping, agility ladder drills, and high knees), and a control group (n=120), which maintained their regular activities. The experiment lasted for 10 weeks, with variables such as diet and sleep patterns controlled. The measured indicators included cardiopulmonary function (Step Test Index), physical fitness (standing long jump and 50-meter sprint results), and mental health (Self-Rating Anxiety Scale [SAS] scores).

Results The survey results revealed that 82.3% of adolescents accumulated 10-30 minutes of short-bout physical activity daily. The primary activities were walking (48.6%), rope skipping (25.4%), and extended inter-class exercises (16.7%). The main motivation for participation was to "relax the body and alleviate academic fatigue" (68.9%). Key barriers included "lack of fixed exercise space" (42.1%), "absence of professional guidance" (31.5%), and "encroachment of academic tasks" (27.8%). The experimental data demonstrated significant improvements in the experimental group post-intervention: the Step Test Index increased by 15.2%, standing long jump distance improved by 5.3 cm, 50-meter sprint time decreased by 0.4 seconds, and SAS scores reduced by 21.6 points. In contrast, the changes in these indicators for the

control group were all less than 3%, with statistically significant differences observed between the two groups ($P<0.05$). However, it was also found that 38.7% of adolescents failed to reach moderate intensity (heart rate of 120-140 bpm) during their short bouts of activity, and 29.3% struggled with adherence due to reasons such as "forgetting" or "lack of peer participation," indicating insufficient sustainability.

Conclusion Short bouts of physical activity offer significant health benefits for adolescents, including enhancing cardiopulmonary function, improving lower-limb explosive power, increasing sprint speed, and alleviating anxiety. It can serve as a crucial supplement to address insufficient physical activity. Nevertheless, challenges related to managing exercise intensity, ensuring adherence, and inadequate school-based integration must be addressed. Recommendations: At the school level, it is recommended to develop "Campus Micro-Workout Guidelines," create 15-20 small exercise zones in corridors, playground corners, and open ground floors of buildings, and add a "Short-Bout Exercise Skills" module to physical education curricula (e.g., teaching 10-minute high-efficiency fat-burning routines). At the family level, parents should be encouraged to engage in short-duration activities with their children during commutes (e.g., brisk walking, ball juggling, parent-child rope skipping). At the societal level, community sports facilities within a 3-kilometer radius of schools should be promoted to offer 2 hours of free access to adolescents daily. Collaborative "Short-Bout Exercise Check-in" events should be organized with schools to construct a synergistic integration pathway involving families, schools, and the community.

Keywords: Short Bouts of Physical Activity; Adolescents' Health; School-Based Integration; Health Benefits; Physical Fitness

Research on the "Interest-based Community" Effect and Health Promotion Pathways of Adolescent Sports Participation in the Digital Age

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Abstract With the rapid development of digital technology, the patterns of adolescent sports participation are undergoing profound changes. Their physical activity behaviors are increasingly organized around digital spaces, forming "affinity-based online communities" centered on shared interests and values. This study aims to investigate the internal mechanisms through which digital "affinity-based online communities" influence adolescent sports participation and attempts to construct a set of health promotion pathways for adolescents based on these digital communities. A mixed-methods approach was adopted, implemented in two stages. The first stage consisted of qualitative research, involving semi-structured interviews with 20 adolescents active in different types of sports affinity communities to deeply explore their participation motivations, community interaction patterns, emotional experiences, and changes in health perceptions. The second stage was quantitative research; based on the qualitative findings, a questionnaire was designed and administered to 400 middle school students. Statistical methods were used to verify the causal relationships between variables such as social support, role modeling, and community norms within these affinity communities, and adolescents' sports participation intensity, exercise adherence, physical self-esteem, and overall mental health level. The main findings are as follows: 1. Affinity-based communities effectively lower the initial barrier to exercise and stimulate adolescents'

interest in sports participation by providing rich audiovisual content, low-threshold participation methods, and strong entertainment value. Mechanisms like check-ins and points within the communities significantly enhance the fun and adherence of exercise behaviors. 2. Digital communities construct a network of "companions" that transcends geographical limitations for adolescents. Interactions such as likes, comments, and experience sharing among members provide crucial emotional and informational support, while the presence of role models like "UP owners" offers a powerful demonstration effect, boosting adolescents' self-efficacy. 3. Affinity-based communities may also harbor potential risks. For instance, excessive pursuit of "check-in" data may lead to sports injuries; overemphasis on "perfect body shape" can trigger body anxiety; and the "encapsulation" within communities might weaken offline, real-world interpersonal interactions to some extent. The study concludes that digital "affinity-based online communities" have become a significant that cannot be ignored in promoting adolescent sports participation and health well-being. The core of their effect lies in internalizing exercise motivation by fulfilling adolescents' basic psychological needs for belonging, autonomy, and competence. Based on this, the following health promotion pathways are proposed: 1. Guidance and Empowerment Pathway: It is recommended that schools and families shift their perspectives, recognize and guide adolescents in the rational use of digital sports communities, and cultivate their digital health literacy to enable critical use of community resources and avoid potential risks. 2. Integration and Innovation Pathway: Schools are encouraged to proactively collaborate with high-quality digital platforms to develop blended teaching models that combine "online guidance and offline practice," thereby introducing the vitality of affinity communities into curricular and extracurricular activities. 3. Governance and Support

Pathway: A call is made for relevant platforms to strengthen their social responsibility, foster a positive, inclusive, and scientific community culture, and provide necessary health education and risk warnings for adolescents.

Keywords: Adolescent Health; Digital Age; Affinity-Based Online Communities; Sports Participation; Health Promotion

Research progress on the rehabilitation effect of different sports on children with autism spectrum disorder

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Abstract Objective Against the backdrop of the sports-medicine integration, this study explores the intervention effects and development trends of different exercise modalities in children with ASD, with the aim of providing a reference for developing personalized exercise rehabilitation programs for these children.

Methods A systematic review of relevant literature was conducted using databases such as CNKI, PubMed, EBSCO, and Springer Link. The search timeframe was the last 10 years, from March 2015 to March 2025. The Chinese search strategy included terms in Title/Abstract: Autism Spectrum Disorder OR Autism OR ASD AND Exercise Therapy OR exercise intervention OR Exercise rehabilitation OR exercise. The English search strategy was: Title/Abstract: Autism Spectrum Disorder OR Autism OR ASD AND Exercise Therapy OR exercise intervention OR Exercise rehabilitation OR exercise. **Inclusion criteria:** Study participants were children aged 0-18 with ASD meeting the diagnostic criteria of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5); intervention type was exercise rehabilitation; outcome measures reflected the impact of exercise rehabilitation on functional impairments in children with ASD; Chinese and English literature. **Exclusion criteria:** Duplicate publications; irrelevant themes; unclear intervention content; unclear evaluation indicators or lack of measurement data. This study adopted the

PICO framework (Population, Intervention, Comparison, Outcome) for evidence synthesis, systematically analyzing how exercise rehabilitation interventions improve core symptoms and motor dysfunction in children with ASD and discussing future trends

Results This study included 14 articles, with 11 from China, 1 from the United States, 1 from Spain, and 1 from the Czech Republic. All included articles were quantitative studies covering sports science, rehabilitation medicine, psychiatry, and public health, focusing on the impact of interventions such as equestrian sports, ball games, and motion-sensing games on the rehabilitation of children with autism.

Conclusions and recommendations Research indicates that exercise can improve core symptoms and motor dysfunction in children with ASD. However, most studies involve group interventions, with few case studies. ASD research is characterized by significant clinical heterogeneity and substantial individual differences. Substantial evidence demonstrates that different forms of exercise can activate specific brain region connections, enhance both gross and fine motor skills, and ameliorate core symptoms in children with ASD. Exercise interventions can effectively improve core symptoms and motor dysfunction in children with autism. Future exercise rehabilitation programs for children with ASD should emphasize multidisciplinary collaboration, utilize approaches combining artificial intelligence with exercise rehabilitation, and develop personalized, low-cost rehabilitation plans using family exercise rehabilitation apps. Establishing a prescription database for exercise rehabilitation in ASD can promote the integrated development of industry, academia, and research, meet the rehabilitation needs of families with ASD children, reduce family burdens, translate scientific research findings into practical rehabilitation outcomes, and advance the field of rehabilitation for children with ASD.

Keywords: autism; sports rehabilitation; sports-medicine integration

Analysis of Research Hotspots and Trends in Physical Education Homework in China Based on CiteSpace

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Abstract With the continuous advancement of social development and educational reform, research on physical education homework has gained increasing attention. Despite a growing body of literature in recent years, systematic analysis of authors, publication volume, institutions, research hotspots, and future trends remains lacking. To comprehensively understand research dynamics in China's physical education homework field and promote high-quality development, this study employs bibliometric methods using CiteSpace 6.3.R1 software to conduct a visualization analysis of 464 relevant articles indexed in the China National Knowledge Infrastructure (CNKI) database. The findings reveal:

(1) From 1994 to 2024, the overall publication volume in China's physical education homework research field has shown a gradual upward trend. This field has garnered increasing attention and importance in recent years, with research activity steadily rising and likely to maintain a growth trajectory in the future.

(2) The academic collaboration network in this field is active, yet overall cooperation remains relatively loose. Individual authors such as Wu Chengyun and Zhang Shikun have published extensively and exerted considerable influence. While some research teams have established collaborations involving four or more members, two-person collaborations are more prevalent, indicating the absence of a stable core collaborative structure.

(3) Most academic institutions maintain bilateral cooperative relationships, with only three groups of institutions forming collaborations involving three or more institutions. Although cooperative relationships exist between some institutions, the majority remain independent, lacking close collaboration.

(4) Key research keywords in the field of physical education homework primarily encompass elementary school physical education, extracurricular assignments, and core competencies. These keywords highlight core themes in physical education homework research, specifically focusing on homework design and assignment, implementation and effectiveness, student physical fitness development, and core competencies.

(5) Keyword analysis of physical education homework research reveals 21 distinct research frontiers across different stages, exhibiting temporal characteristics. Early research frontiers include “physical activities,” “children,” and ‘assignment’; mid-stage frontiers encompass “physical fitness,” “classroom instruction,” “parents,” and “lifelong physical education”; later-stage frontiers feature “evaluation,” “physical education,” and “school-home collaboration”; while the latest frontiers involve “design,” “strategies,” “Double Reduction,” “junior high physical education,” and “school physical education.”

Given the ongoing deepening of basic education curriculum reform, core competencies, policy measures, and evaluation will remain focal points in the foreseeable future. This suggests integrating core competencies into the design, implementation, and assessment of physical education homework, optimizing evaluation mechanisms, enhancing the quality of homework implementation, and promoting integrated development across classroom and extracurricular settings.

Keywords: physical education homework; visualization analysis; CiteSpace; core competencies

The effect of aerobic exercise on myocardial oxidative stress in obese mice induced by high-fat diet

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Abstract Objective To establish an obesity model in mice by high-fat diet and conduct intervention groups to explore the effect of aerobic exercise on myocardial oxidative stress in obese mice.

Methods Eight-week-old SPF C57BL/6 male mice were housed with 20°C - 25°C and 40% - 50% humidity, natural lighting, free access to food and water. After 1 week of adaptive feeding, the body weight of all mice was measured, and they were randomly divided into the normal diet quiet group (OQ), the high-fat diet quiet group (FQ), and the high-fat diet with exercise group (FE). After 8 weeks of high-fat diet induction of the obesity model, the success rate of modeling was determined. The FE group received 16 weeks of moderate-intensity aerobic exercise intervention. The initial speed was 13 m/min, 60 minutes per day, and the speed was increased by 1 m/min every other week, 5 days per week. During the exercise intervention, the physiological responses and adaptation of the experimental animals were closely monitored, and necessary adjustments were made according to the actual situation. After the intervention, all groups of mice were fasted for 12 hours, and the weights of each group of mice were measured. Myocardial morphological indicators, lipid levels, and expression of oxidative stress-related proteins were measured.

Results (1) The perirenal fat, epididymal fat, and body weight of the FQ

group were significantly higher than those of the OQ group ($p < 0.01$). The perirenal fat, epididymal fat, and body weight of the FE group were significantly lower than those of the FQ group ($p < 0.01$ or $p < 0.05$). (2) The TC, TG, and LDL-C of the FQ group were significantly higher than those of the OQ group ($p < 0.01$), and the HDL-C was significantly lower than that of the OQ group ($p < 0.01$). The TC, TG, and LDL-C of the FE group were significantly higher than those of the OQ group ($p < 0.01$) and significantly lower than those of the FQ group ($p < 0.01$). The HDL-C of the FE group was significantly higher than that of the FQ group ($p < 0.01$). (3) The levels of GSSG, 4-HNE, and MDA in the FQ group and FE group were significantly higher than those in the OQ group, and the levels of GSH and TSOD were significantly lower than those in the OQ group ($p < 0.01$). Compared with the FQ group, the levels of GSH and TSOD in the FE group were significantly increased, and the levels of GSSG, 4-HNE, and MDA were significantly decreased ($p < 0.01$). (4) The protein expression of Nrf2 and GPX4 in the FQ group was significantly lower than those in the OQ group and FE group ($p < 0.01$). The expression of NQO1 in the OQ group was significantly higher than that in the FQ group and FE group ($p < 0.01$), and it was significantly higher than that in the FQ group ($p < 0.05$). The expression of NOX1 in the FQ group was significantly higher than that in the OQ group and FQ group ($p < 0.01$). The expression of HO-1 in the FE group was significantly higher than that in the OQ group and FQ group ($p < 0.01$). The body weight, perirenal fat, and epididymal fat of the FE group were lower than those of the FQ group, and the reduction of visceral fat can reduce the amount of free fatty acids entering the liver and the generation of VLDL, while improving insulin sensitivity, inhibiting liver lipid synthesis, and ultimately achieving a decrease in blood TG, TC, LDL-C and an increase in HDL-C, confirming the beneficial effect of aerobic exercise in obesity management. Aerobic exercise can improve heart function was improved after aerobic exercise by activating the

Nrf2-mediated oxidative system. ROS signaling activates Nrf2, which dissociates from Keap1 and enters the nucleus, binds to ARE to promote the expression of antioxidant genes such as NQO1, HO-1, and SOD, and indirectly maintains the activity of GPX4 to inhibit myocardial ferroptosis. The results showed that the expression of Nrf2 pathway-related proteins in the FE group (except NOX1) was significantly higher than that in the FQ group, and the low expression of NOX1 could reduce myocardial oxidative stress injury.

Conclusion Aerobic exercise has a significant improvement effect on myocardial oxidative stress in high-fat diet-induced obese model mice, which can alleviate the degree of myocardial injury. The mechanism may be related to the activation and expression regulation of genes and proteins in the Nrf2/GPX4/Ferroptosis pathway.

Research on the Governance Model Differentiation of Provincial Football Leagues from the Perspective of Resource Dependence Theory: A Comparative Analysis of Jiangsu's "Su Chao" and Jiangxi's "Gan Chao"

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Abstract Objective This article takes the resource dependence theory as the analytical framework, focusing on the two provincial football leagues of Jiangsu "Su Chao" and Jiangxi "Gan Chao", and deeply explores the intrinsic connections between the resource dependence structure, resource acquisition strategies and governance model choices of "Su Chao" and "Gan Chao", aiming to reveal the governance strategies and sustainable development paths of football leagues under different resource environments. Furthermore, it provides theoretical explanations and practical references for the development of football leagues in regions with different resource conditions.

Methods By applying the methods of literature review, case analysis and comparative analysis, the key resources that the two leagues rely on are systematically sorted out from four dimensions: economy, politics, human resources and social resources, and how they affect the governance structure and development path of the leagues are analyzed.

Results Relying on its superior resource environment, "Suchao" has formed a collaborative governance model of "government-led and market-driven". Jiangsu Province has a large economic aggregate, a mature market mechanism and active social

capital, which provides the league with abundant commercial sponsorship, media resources and a fan base. The government plays more of a "guide" and "enabler" role in governance. By building platforms, providing policy support and infrastructure, it stimulates the enthusiasm of the market and social entities, thus forming a virtuous cycle of "the government providing the stage, the market performing, and social participation". However, due to resource constraints such as a weak economic foundation, insufficient accumulation of football culture and an immature market mechanism, the "Gan Chao" has adopted an administratively driven model of "government-led and market-supplemented". The government promotes the orderly operation of the league by providing financial support, venues and organizational resources. Market forces play more of an auxiliary role, with limited sponsorship scale and low social participation. The operation of the league relies more on administrative promotion. The two governance models are rational adaptations to the local resource environment. The "Su Chao" model reflects an "optimized path" for resource-rich regions to achieve efficient resource allocation through government guidance and market collaboration. The "Gan Chao" model represents the "foundational path" for resource-scarce regions to rely more on administrative power to build a system.

Conclusion This study emphasizes that the governance model of provincial football leagues should be adapted to local conditions and avoid a one-size-fits-all approach. Organizations need to first assess their local resource structure and then select governance strategies that are in line with it. The successful experiences of the Jiangsu Premier League and the Jiangxi Premier League demonstrate that the key to building a resilient event ecosystem lies in maintaining a dynamic

balance among various external resources and promoting sustainable development among all parties through resource complementarity and benefit sharing. Based on this, the following suggestions are put forward: (1) Integrate the derivative resources of the event, enhance the IP value and service system, and promote a virtuous cycle of resources; (2) Promote the deepening of the government's role from “empowerment” to “governance”, and strengthen the formulation of industry standards and fair competition supervision; (3) Encourage clubs to establish modern enterprise systems and community root culture, and promote the upgrading of “regional ips” to “century-old clubs”.

Keywords: Resource Dependence Theory; Provincial football league; Governance model; Su Chao; Gan Chao; Comparative study

A Survey and Analysis of the Development Status of Sensory Integration Ability in Children Aged 3-6

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Objective Sensory integration is a coordinated learning process between the brain and body, and the age of 3-6 is the golden period for the development of sensory integration system in children. The purpose of this study is to understand the current status of sensory integration ability development in children aged 3-6, and provide a reference for subsequent intervention research.

Methods The sensory integration ability scale developed by Ren Shaobo was used to assess 246 children aged 3-6 years in Zhanjiang, Shantou, Huizhou, and Qingyuan. This 56-item scale evaluates six dimensions: visual, auditory, proprioceptive, vestibular, tactile, and developmental disorders. A 1-5 point scale was employed, with higher scores indicating greater dysfunction. T-scores were converted into gender percentiles, with P65, P75, and P95 thresholds defining mild, moderate, and severe sensory integration dysfunction, respectively. SPSS27.0 was used to perform ANOVA on total scores and dimension-specific scores across gender, age, and kindergarten type, while chi-square tests were applied to compare the prevalence of sensory integration dysfunction among children.

Results (1) Overall Sensory Integration Status of Children Aged 3-6. The total sensory integration scores indicate that children aged 3-6 are generally in a state of mild dysfunction. Individually, 38 children (29.69%) showed mild dysfunction, 73 (57.03%) moderate dysfunction, and 17 (13.28%) severe dysfunctions. Chi-square test revealed significantly

higher dysfunction rates in sensory integration scores, auditory, tactile, and developmental disorders compared to normal levels. (2) Age-related Differences in Sensory Integration Among 3-6-Year-Olds. Total scores indicate that children aged 3-4, 4-5, and 5-6 are all in mild dysfunction. ANOVA showed no significant differences in total scores or dimensional scores across age groups. However, dysfunction rates varied significantly: 4-5 years showed the highest total score dysfunction rate, followed by 3-4 and 5-6 years. Visual and proprioception dysfunction rates were highest in 3-4 years, while auditory, vestibular, tactile, and developmental disorder rates were highest in 4-5 years. (3) Gender Differences in Sensory Integration Abilities. ANOVA revealed significant gender differences in proprioception and developmental disorders, with boys scoring significantly higher than girls in both. Boys also showed significantly higher dysfunction rates in total sensory integration and vestibular perception. (4) Differences in Sensory Integration Abilities Between Public and Private Kindergartens. The results revealed significant differences in sensory integration among children in public and private kindergartens, with notable variations in both the total sensory integration score and individual dimensions (auditory, vestibular, and tactile). Children in private kindergartens showed significantly higher rates of sensory integration dysfunction in both the total score and its components compared to their public counterparts.

Conclusions (1) Over 50% of children aged 3-6 exhibit mild sensory integration dysfunction, with tactile dysfunction being the most prevalent and visual dysfunction the least common. Age and gender differences exist in sensory integration among 3-6-year-olds: the 4-5 age group shows the highest prevalence of sensory integration dysfunction, while the 5-6 age group demonstrates lower rates. Male children demonstrate higher prevalence of sensory integration dysfunction than females, with males

showing the most severe tactile dysfunction and the least severe proprioceptive dysfunction, whereas females exhibit the highest auditory dysfunction and the least severe vestibular dysfunction. There are differences in the incidence of sensory integration dysfunction between public and private kindergartens, with private kindergartens showing higher rates than public ones. (2) Parents are advised to prioritize the development of children's sensory integration abilities by increasing outdoor physical activities and opportunities to engage with their environment through touch. Kindergartens should enhance sensory integration training for young children, ensuring they spend at least 2 hours daily on outdoor physical activities.

Observation on Kinesiology Tape Stimulating Acupoints on the Healthy Side for Pain Intervention After ACL Reconstruction

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Abstract Objective Rehabilitation after anterior cruciate ligament (ACL) surgery is complicated by multiple factors, including the pathological complexity of the condition, limitations of existing intervention methods, significant individual differences among patients, and poor rehabilitation coordination. These factors interact to form a vicious cycle of "pain-functional impairment," increasing the complexity of pain management. Kinesiology tape is a non - invasive rehabilitation tool used postoperatively, and stimulating acupoints on the healthy side is a common practice in traditional Chinese medicine (TCM) to reduce the release of inflammatory factors and alleviate postoperative pain. However, there is currently no relevant research on whether stimulating acupoints on the healthy side with kinesiology tape can improve pain after ACL surgery. This study aims to verify the effectiveness of stimulating acupoints on the healthy side with kinesiology tape in improving pain after ACL surgery, and to provide a safe and non-invasive new adjuvant method for post-ACL surgery rehabilitation.

Methods A total of 40 patients who underwent ACL reconstruction surgery within 48 hours at the Third Affiliated Hospital of Southern Medical University and met the inclusion and exclusion criteria were selected. They were randomly divided into an experimental group and a control group using a double - blind method, with 20 patients in each group. Both groups received conventional rehabilitation treatments,

including bioelectrical stimulation, exercise training, ice application, and compression bandaging. On this basis, the experimental group was treated with type I kinesiology tape applied to the Zusanli (ST36), Yanglingquan (GB34), Weizhong (BL40), Xuehai (SP10), and Heding (EX - LE2) acupoints on the healthy side with a tension of 50% - 75%, and the tape was replaced every 48 hours. The control group was applied with type I kinesiology tape at 0 tension to the same acupoints, with the same replacement frequency as the experimental group. The intervention for both groups was conducted 3 times a week for 2 consecutive weeks. The Visual Analogue Scale (VAS) was used as the main evaluation index. Statistical analysis was performed using SPSS 26.0 software. Paired sample t - test was used for intragroup comparison before and after intervention, and independent sample t - test was used for intergroup comparison. A P value of < 0.05 was considered statistically significant, and a P value of < 0.01 was considered extremely statistically significant.

Results Before the intervention, there was no significant difference in the Visual Analogue Scale (VAS) scores between the two groups ($P > 0.05$). After the intervention, the VAS scores of both groups decreased significantly compared with those before the intervention: Experimental group: The VAS score decreased from 7.1 ± 1 points to 4.3 ± 1 points ($P < 0.01$); Control group: The VAS score decreased from 7.05 ± 0.9 points to 6.15 ± 0.93 points ($P < 0.05$). Moreover, the VAS score of the experimental group was significantly lower than that of the control group, and the inter-group difference was extremely statistically significant ($P < 0.01$).

Conclusion On the basis of conventional rehabilitation treatment, applying kinesiology tape with 50%–75% tension to stimulate acupoints on the healthy side can significantly reduce the subjective pain of patients after anterior cruciate ligament (ACL) surgery. This study provides a new

pain management scheme that is both safe and effective for patients after ACL surgery.

Keywords: endomyography patch; postoperative ACL pain; unaffected side acupuncture point; taping tension; analgesic effect

The Effect of Core Stability Training on Patellofemoral Pain Syndrome

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Abstract Objective Patellofemoral Pain Syndrome (PFPS) is a representative knee joint disorder in clinical practice, with distinct characteristics of high-risk populations. Its pathological mechanism is associated with abnormal friction between the femur and the patella. After the onset, it causes joint discomfort and pain in patients, which in turn limits their physical activities. If effective intervention is not provided for a long time, the disease is prone to progress to more severe knee joint lesions such as cartilage wear and patellar subluxation. This not only significantly impairs the patients' motor function but also seriously affects their quality of life, forming a vicious cycle of "pain - limited activity - functional decline". This study aims to clarify the intervention effect of core stability training on pain intensity, knee joint function, and quality of life in patients with Patellofemoral Pain Syndrome (PFPS), and to provide empirical evidence for optimizing clinical rehabilitation protocols.

Methods A total of 20 PFPS patients (aged 20–45 years) diagnosed by the First People's Hospital of Guangzhou were selected. Using a randomized controlled trial design, they were divided into an experimental group and a control group, with 10 patients in each group (n=10). The control group received conventional exercise therapy (including seated resistance knee extension, prone resistance knee flexion, 1/2 squat, 1/4 single-leg squat, and wall-sit training) plus physical therapy. On the basis of the control group's intervention protocol, the experimental group additionally received core stability training (including resistance hip abduction, plank, double-bridge exercise, single-bridge exercise, and side

plank training). The intervention period for both groups was 4 weeks. Before and after the intervention, the patients' relevant indicators were evaluated using the following scales: Visual Analogue Scale (VAS): To assess pain intensity; Lysholm Knee Scoring Scale (LKSS) and Patellar Jukala Score: to assess knee joint function; 36-Item Short Form Health Survey (SF-36): to assess quality of life. SPSS 26.0 statistical software was used to perform independent samples t-test for data analysis, with a significance level set at $P<0.05$ (i.e., $P<0.05$ indicated a statistically significant difference).

Results Before the intervention, there were no statistically significant differences in VAS score, LKSS score, Patellar Jukala Score, or SF-36 score between the two groups ($P>0.05$). After the intervention, all the aforementioned indicators of both groups were significantly improved compared with those before the intervention (intra-group comparison, $P<0.05$), and the improvement magnitude of the experimental group was significantly better than that of the control group (inter-group comparison, $P<0.05$). The specific data are as follows: The VAS score of the experimental group decreased from 6.10 ± 0.73 to 2.40 ± 0.69 ; The LKSS score of the experimental group increased from 61.70 ± 3.62 to 80.6 ± 3.06 ; The Patellar Jukala Score of the experimental group increased from 56.3 ± 5.07 to 80.5 ± 4.3 ; The SF-36 score of the experimental group increased from 45.0 ± 3.23 to 64.10 ± 4.97 . The improvement effects of the above indicators in the experimental group were all better than those in the control group at the same period.

Conclusion A 4-week core stability training can effectively alleviate pain symptoms in patients with PFPS, significantly improve their knee joint function and quality of life, and thus can be used as one of the preferred options for clinical exercise rehabilitation of PFPS.

Keywords: patellofemoral joint pain syndrome; core stability

training; degree of pain; Functional improvemen

Theme 2

The Development of the Health Industry

Esports as an Element of the Digital Economy

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Abstract The article is devoted to the analysis of the economic essence of the concept "esports" through the examination of its subjects and objects, factors, and development directions. The primary factors for the formation and development of esports are identified as: technological innovations, diversification of investment flows, and the size of the target audience.

The modern economic paradigm is characterized by the intensity of digital transformation across all spheres of society, which is a consequence of the emergence and rapid development of fundamentally new economic industries.

Esports is an organized activity involving the use of computer games and the presence of a competitive component [1]. A different viewpoint is held by D. Heaven, who understands esports as an entertainment sport based on individual players or teams playing various computer games against each other [2].

Today, esports are officially recognized in more than forty-five countries worldwide. The leading countries in the global esports ranking are the USA, China, South Korea, and Russia.

According to the analytical company NewZoo, the number of active video game players reached 3.38 billion people in 2023, and the audience for esports broadcasts is approaching 600 million viewers. The global esports market size is estimated at \$2.11 billion in 2024, with a projected

growth to \$33 billion by 2032. This trend indicates the formation of a large-scale economic ecosystem.

In the Republic of Belarus, esports began to develop around 2000. In 2016, the Republican Public Association «Belarusian Federation of esports was established». Currently, in the Republic of Belarus, esports is developing as a new type of competitive sports activity and a specialized practice of training individuals for competitions based on computer hardware, software, interactive devices, and other capabilities of computer technologies. It also contributes to preparing the country's citizens for life in an information society and promoting a healthy lifestyle.

The problematic aspects of esports development in the Republic of Belarus include: lack of a system for legal regulation of esports entities and intellectual property protection; high investment dependency and market instability risks; absence of a social security system for players.

Prospects for further research are seen in the following directions [3–4]: - analysis of the impact of specific government policy measures (tax incentives, grants) on the growth rates of national esports industries; - study of the economic sustainability of esports organizations and development of standard business models that minimize risks; - sociological and economic research on the impact of esports betting and the development of consumer protection mechanisms.

Thus, esports represents not merely a hobby of the younger generation, but a full-fledged economic sector requiring deep academic understanding and the development of balanced approaches to its management and integration into the overall economic system.

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Innovative Clusters as a Modern Form of Integration of Science, Education and Sports

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Abstract This paper examines the concept of innovative clusters as a modern form of integration of science, education, and sports. The structure, role in professional training, as well as problems and prospects of their implementation in educational and sports practice, are identified.

Keywords: innovative clusters, integration, education, sports, science, digitalization, specialist training.

Relevance The modern development of physical culture and sports is characterized by digitalization, interdisciplinarity, and integration of science, education, and practice. Under these conditions, the need arises for new organizational forms capable of combining the potential of various actors in the sports industry. One of the most effective forms are innovative clusters — integrative structures that unite universities, sports federations, research institutes, and IT companies [1].

Purpose of the Study To identify the features, potential, and directions for the development of innovative clusters as a form of integration of science, education, and sports within the system of professional training in physical culture and sports activities.

Research Objectives 1. To analyze the theoretical foundations of forming innovative clusters in the field of physical culture and sports. 2.

To determine the structure and functions of cluster participants (universities, sports organizations, IT companies, and government institutions).

Research Methods The study employed analysis of scientific literature and regulatory documents, comparative analysis of domestic and foreign experience, a systems approach, and sociological methods (survey, interview) [2].

Results and Discussion Innovative clusters are an effective tool for integrating science, education, and sports. They help create a unified innovation space combining the resources of educational institutions, sports organizations, and the technological sector. Such interaction improves the quality of professional training through the use of digital technologies and project-based learning methods.

The structure of an innovative cluster is based on the distribution of functions among key participants. Universities serve as centers of research, education, and human resource development. Sports federations provide practical bases and apply research results. IT companies develop digital platforms and analytical tools, while government bodies coordinate and invest in innovative processes [3].

Clusterization enhances the quality of professional training. Students participate in real scientific and applied projects, developing competencies in digital technologies, analytics, and sports management [4]. Moreover, clusters stimulate research activity, promote the creation of laboratories and competence centers, and facilitate the integration of innovations into educational and sports practices.

The implementation of the cluster approach results in: - the growth of interdisciplinary competencies among students; - strengthened interaction

between science and sports practice; - the establishment of research centers and laboratories; - increased student motivation for scientific activity.

However, the development of clusters faces several challenges: lack of a unified strategy for cooperation, insufficient funding, shortage of personnel with interdisciplinary competencies, and fragmented digital infrastructure. Nevertheless, there is positive progress – in Russia and Uzbekistan, regional clusters are emerging on the basis of universities, creating innovative laboratories and joint research platforms [5].

Thus, innovative clusters contribute to the formation of an integrated ecosystem of sports education, combining scientific research, educational processes, and sports practice. This ensures sustainable sectoral development, increases graduate competitiveness, and promotes the introduction of digital technologies into sports.

Conclusions 1. Innovative clusters are a modern tool for integrating science, education, and sports, contributing to the formation of a unified scientific and educational space. 2. Their development requires regulatory and financial support, as well as the training of personnel with digital and analytical competencies. 3. The prospects of clusters are linked to the digitalization of sports and the formation of international networks for scientific and educational cooperation.

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A Systemic Approach to the Development of Mass Sports: The Experience of Russia's Far Eastern Regions as a Factor in the Sustainable Growth of Population Physical Activity

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Abstract An analysis of mass sports practices in Russia's Far Eastern regions (2020–2024), based on official statistics and a survey (N = 347), has identified the key factors driving the sustainable growth of population physical activity. Success is determined not by individual events but by a systemic approach. The findings are applicable to the development of international strategies for promoting healthy lifestyles.

Today, as physical culture and sport are increasingly viewed as instruments for achieving sustainable development goals, the question of how to effectively engage broad segments of the population in regular physical activity has become particularly relevant. Within the framework of Forum Topic No. 3- “Sport for All: Physical Activity, Healthy Lifestyles, and Inclusion” -we would like to share the experience of Russia's Far Eastern regions, where significant and sustained growth in mass participation rates has been recorded over the past five years [1, 2].

An analysis of data from 2020 to 2024 reveals impressive dynamics.

In Primorsky Krai, the number of people regularly engaged in physical activity increased from 744,000 to 1,026,000. In the Republic of Buryatia, it rose from 430,000 to 568,000. In the Republic of Sakha (Yakutia), it grew from 394,000 to 562,000. Khabarovsk and Kamchatka Krais demonstrated similarly steady growth rates. This trend is not accidental; it is a direct result of the implementation of systemic regional strategies [3, 4, 5].

The key conclusion of our study is that the main driver of growth is not individual sporting events, but rather a systemic approach. Successful regions combine three core elements in their policies: infrastructure development, cultural integration, and targeted audience engagement.

First, there is the development of accessible infrastructure. As our survey of Far Eastern residents shows, 38.2% of respondents consider access to sports facilities insufficient, while 12.2% have no access at all. Leading regions are actively addressing this issue by constructing new facilities and modernizing existing ones, which directly impacts the ability to engage the population in regular physical activity.

Second, there is the cultural integration of sport. Mass events such as the Vladivostok Marathon, the Baikal Marathon, or the national Spartakiad “Igry Manchaary” in Yakutia have become more than just sporting competitions – they have evolved into significant cultural and social phenomena. They bring together families, friends, and colleagues, creating a sustainable community and establishing a new social norm: that of a healthy and active lifestyle. A sociological survey confirms this: 33.1% of respondents identified joint participation as the top social motivator, second only to health concerns (42.5%).

Third, there is targeted work with different age groups. An analysis of

age demographics shows growth across all categories—from children to older adults. For example, in Khabarovsk Krai, the number of children under 18 engaged in sports increased by more than 19,000, while in Kamchatka Krai, it rose by 7,000. This is the result of deliberate policies in school and extracurricular sports education. Equally important is the growing involvement of people over 55. In Khabarovsk Krai, their number increased from 28,400 to 36,900, indicating the development of “active longevity” programs and the creation of accessible formats for older generations.

However, despite the positive dynamics, the study also identified significant barriers. The primary obstacle, cited by 36.7% of respondents, is a lack of free time. This is especially relevant for the economically active population aged 30–54—the largest group of participants. The second most significant barrier (31.2%) is the absence of facilities near one’s place of residence, underscoring the critical importance of “sport within walking distance.” The third barrier is low awareness (22.9%), pointing to the need for improved communication strategies.

Respondents clearly articulated their expectations: 31% requested more events within walking distance, 22% called for an expansion of free sports sections, 16% emphasized the need for better information dissemination, and 8% advocated for the implementation of digital platforms for registration and schedule management—aligning with Forum Topic No. 6: “Smart Sport: Digital Transformation and Artificial Intelligence.”

Thus, the experience of Russia’s Far East demonstrates that creating truly “sport for all” requires a synergy of efforts. It must be a comprehensive set of measures in which mass events serve as the

“locomotive,” infrastructure as the “foundation,” and targeted audience engagement combined with digital technologies as “precision instruments.” Such an approach not only increases participation numbers but also fosters sustainable motivation for a healthy lifestyle—the ultimate goal in the context of sustainable development.

The practices presented can be adapted and applied in other countries, including China and Belarus, taking into account their national and regional specifics. International dialogue, such as this forum, provides an ideal platform for exchanging such successful models and collaboratively developing even more effective strategies.

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Research on the Integration Pathways and Product Innovation of Sports Wellness Industry in the Context of the Silver Economy

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Research Objective Against the backdrop of accelerating population aging in China and the sustained rise of the "silver economy," there has been a significant increase in demand for sports wellness services among the elderly, which combine health protection with recreational attributes. However, the current sports wellness industry faces issues such as shallow integration levels, severe homogenization of product offerings, and incomplete service chains, making it difficult to fully meet the diverse needs of the elderly. This study aims to clarify the intrinsic connections between the "silver economy" and the sports wellness industry, define the core logic of industrial integration, explore product innovation directions that align with the physiological characteristics and demand preferences of the elderly, and provide theoretical references and practical pathways to enhance the quality of healthy living for the elderly.

Research Methodology The literature review method involves systematically reviewing core literature on "silver economy," "sports and health," and "industrial integration" from domestic and international sources to clarify the theoretical framework of industrial integration, the

research progress in elderly sports services, and the key findings and gaps in existing studies. The case analysis method selects exemplary sports and health projects from both domestic and international contexts, including Japan's elderly sports rehabilitation communities, Germany's hot spring sports and health towns, and domestic examples such as the Boao Sports and Health Complex in Hainan and the Tai Chi Health Base in Weihai, Shandong. This approach enables an in-depth analysis of different project operational models, integration methods, and product design concepts, distilling actionable insights. The questionnaire method involves distributing surveys to elderly populations across various districts of Guangzhou, focusing on their preferences for sports and health products, selection tendencies, and usage feedback, thereby collecting first-hand demand data to support research conclusions.

Research findings Currently, the sports and wellness industry has initially formed three major integration directions: "sports + healthcare," "sports + tourism," and "sports + community elderly care." However, there are differences in the depth of integration across these directions: - "Sports + healthcare" primarily focuses on sports rehabilitation and basic intervention for chronic diseases, with limited-service coverage and no widespread connection with grassroots medical resources. "Sports + tourism" mainly adopts destination-based sports experiences, with product designs often following a uniform model, failing to fully account for individual differences in elderly mobility and health conditions. "Sports + community elderly care" remains largely at the level of basic sports facility provision and simple guidance, lacking a complete loop with health monitoring and follow-up rehabilitation services. From the demand side, elderly individuals prioritize the functionality, safety, and

accessibility of sports and wellness products when making choices. Moreover, there are notable differences in product preferences among the elderly based on their health conditions and life backgrounds, highlighting a strong demand for personalized and scenario-specific offerings.

Research Findings and Recommendations Under the backdrop of the "silver economy," the integration of the sports and health care industry is an inevitable trend that aligns with the evolving needs of the elderly and industrial transformation. However, its development must overcome the "superficial collaboration" dilemma and advance toward deep resource integration and the construction of a closed-loop service system. The mismatch between product supply and the actual needs of the elderly population is the core issue constraining industry growth, and product innovation should be guided by the principles of "stratification and personalization." Policy guidance, resource integration, and demand insight are key factors in driving industry convergence and product innovation. Based on this, this study proposes the following recommendations: First, at the governmental level, specialized policies should be introduced to integrate the sports and wellness industries, clarify cross-departmental resource-sharing mechanisms, and promote efficient coordination of sports, medical, and elderly care resources. Second, at the corporate level, enterprises should design tiered products covering different dimensions such as basic rehabilitation, health improvement, and leisure experiences, tailored to the diverse needs of the elderly, while leveraging aging-friendly technologies to enhance product safety and adaptability. Third, at the industry level, efforts should be made to strengthen the cultivation of specialized professionals in elderly

sports and wellness, improve the community sports and wellness service network, and ensure that the elderly can access high-quality sports and wellness services more conveniently.

Community-Based Management of Hypertension: Combination of Exercise and Diet

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Abstract Objective The aim of this study was to construct a meta-analysis based on international guidelines (ISH 2020, ACSM 2018) and empirical evidence (Pedersen & Saltin, 2006, 2015; Di Raimondo et al., 2021) hypertension community comprehensive management model, by integrating scientific exercise prescription (mainly aerobic exercise, supplemented by strength training) and diet therapy, combined with group management (ABC classification) and professional supervision mechanism, to verify its feasibility and effect in the actual community. The core objectives include reducing the blood pressure levels (systolic/diastolic) of pre-hypertensive and diagnosed patients, improving cardiopulmonary endurance and physical fitness, reducing medication dependence, and ultimately achieving the long-term goal of reducing the incidence and mortality rates related to hypertension. The study also aims to address the neglect of exercise therapy in traditional community management, providing practical evidence for low-cost, wide-ranging hypertension prevention and control.

Methods This study used a prospective group management intervention model based on the ABC simplified classification system of the 2020 ISH Global Hypertension Guidelines. Eligible participants (excluding patients with multiple risk factors for hypertension and

diabetes) were divided into three groups: Group A. (Ultra-low risk, normal high blood pressure without risk factors) 60 minutes of moderate-intensity exercise (jogging/square dancing, etc.); Group B (Low risk, Grade 1 hypertension with 1-2 risk factors) Do 45-60 minutes of moderate-intensity exercise (fast walking/tai chi, etc.); Group C (moderate risk, stage 2 hypertension or stage 1 with 1-2 risk factors) should engage in 30-45 minutes of moderate-low intensity exercise (such as slow walking/ Eight Section Brocade). The exercise plan is implemented daily from 7-8 am, requiring a minimum of 3 times per week, with professional exercise leaders, personalized prescriptions based on ACSM guidelines, and dynamic monitoring. Establish a three-dimensional intervention system of "exercise-diet-monitoring": Self-measure blood pressure and heart rate before and after daily exercise and report it; The combination of diet and exercise therapy was performed at least once a week, and the dietary conditions were recorded for 48 hours. Sports team leaders need to complete multi-module professional training. (Including hypertension pathology, exercise contraindications, emergency treatment, etc.) Regularly feedback the health data of members to the medical team to assist in adjusting the treatment plan. A quality control mechanism is set up, and those who are absent for more than 2 weeks will automatically exit. Patients with secondary hypertension need to present a certificate from a sports physician to participate.

Results Advantages of the model: scientific grouping (ISH/ACSM guidelines), low-cost universal design, core exercise therapy, and effective supervision mechanisms to improve compliance. Limitations: Unverified, insufficient personalization, high difficulty in assessing

special populations (secondary hypertension), and safety for blood pressure fluctuation remains to be examined. Theoretical speculation suggests improved community management efficiency, but the actual effect and risk need empirical evidence.

Conclusion At the theoretical level, this model innovatively integrates multi-disciplinary guidelines, providing a low-cost and scalable new solution for the prevention and control of hypertension. The actual effect remains to be verified. It is suggested that small-scale pilot projects be prioritized, the grouping standards and exercise prescriptions be optimized, medical and sports collaboration be strengthened, and intelligent monitoring technology be introduced to lay a foundation for large-scale promotion.

Keywords: Hypertension management; Community Health Management; Exercise therapy; Diet therapy; Group Management; Health monitoring; International Guidelines; Professional supervision mechanism

On the Pathway and Methodology of Guangdong State Farms in Cultivating Applied Sports Teachers for the Belt and Road Initiative

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Abstract: Guangdong Nongken Rubber set up "Canton Reclamation school" overseas, broke the bottleneck of matching Chinese education with demand, and put digital transformation, advanced management mode and teacher training in the engine position of Chinese education innovation and improving the quality of Chinese education. In this paper, the Thai "mahath salad, the Confucius institute at the university of wide (Ken rubber Mekong) practice base" in Chinese, Laos taihua savannakhet worker primary school (guang Ken rubber), and Cambodia wide reclamation rubber spring abundant Lin Xuejiao "glue" much "guang Ken school" by the Chinese teaching practice are summarized, found that these "guang Ken school" fully connected to the government, enterprises and education agencies, The reform of teaching objectives and methods with better thinking has set up a good practice platform for education and training, intelligent Chinese teaching classroom, and international exchanges between Chinese and Chinese education. Finally, this paper combines the student's Chinese teaching situation, different regions around the understanding of local community and build a unified han teach alliance and able to use a variety of teaching tools from three aspects of thinking, to overseas Chinese education international provides reference material for the development of high quality, looking for

overseas teach staff to clarify han han, Help them become application-oriented talents who are good at telling "China stories".

Key words: Guangdong Agricultural Reclamation; One Belt, One Road; Applied talents; International Chinese Language Education

Analysis of Core Elements and Mechanism Construction for Promoting the High-Quality Development of the Water Sports Industry through Paddleboarding under the Industrial Ecosystem Theory

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Abstract Research Objective Driven by the dual forces of the national fitness strategy and the high-quality development of the sports industry, the water sports industry, as an important sub-sector of the sports industry, is facing a critical opportunity for business upgrading and ecological reconstruction. Stand-up paddleboarding (SUP), with its low entry barrier, strong experiential nature, and high social attributes, has seen explosive growth in China in recent years, becoming a core driver for stimulating water sports consumption and linking upstream and downstream industry resources. However, the current integration of SUP with the water sports industry still faces issues such as insufficient synergy, inefficient resource allocation, and broken ecological chains, which limits its impact on the overall development of the industry.

Research Methods This study employs a literature review method to systematically organize domestic and foreign literature on industry ecosystem theory, water sports industry development, and SUP industry research, clarifying the research context and theoretical foundation, and defining core concepts to establish the theoretical framework for subsequent analysis. In addition, through field research, typical regions with mature SUP development in China were selected for in-depth

interviews and on-site observations with local SUP clubs, event operators, equipment manufacturers, government sports management departments, and consumers to obtain first-hand data and practical cases. Using the Delphi method, an expert panel consisting of scholars in the sports industry, water sports event operation experts, professional SUP coaches, and officials from relevant government departments was invited to conduct multiple rounds of consultation and verification to identify the core elements driving high-quality development of the water sports industry through SUP.

Research Results The core elements driving the high-quality development of the water sports industry through SUP can be summarized into five dimensions: First, resource elements, including water resources and talent resources, where accessibility of water resources and professional expertise of talent are fundamental prerequisites; second, business elements, encompassing event economy, experience economy, and equipment economy, with the event economy having the most significant driving effect on other business types; third, policy elements, including industrial planning policies, standardization policies, and support and incentive policies, where the systematization and practical implementation of policies directly influence the direction and speed of industry development; fourth, technology elements, involving equipment technology, operation technology, and safety technology, with innovation and iteration in equipment technology being key to enhancing industry competitiveness; and fifth, market elements, including consumer demand, brand building, and market regulation, with diversified consumer demand driving continuous business innovation. Additionally, system dynamics simulations show that the synergy

between resource and policy elements can increase the growth rate of the water sports industry output value by 15%-20%, whereas insufficient investment in technology elements may lead the industry into a "low-end lock-in" dilemma.

Research Conclusion The role of SUP in promoting high-quality development of the water sports industry is not driven by a single element but by the interconnection and synergy of the five dimensions: resources, business models, policy, technology, and market. These elements form a dynamically balanced industry ecosystem through a closed-loop logic of "resource supply - business innovation - policy guidance - technology empowerment - market feedback." Policy elements play the role of a 'guide' within the factor system, providing institutional support for the efficient operation of other elements by regulating resource allocation directions, incentivizing business innovation, and ensuring technological investment; technological elements act as an 'accelerator,' enhancing the quality and efficiency of industrial development by enabling equipment upgrades and optimizing operational efficiency; market elements function as a 'feedback mechanism,' driving adjustments in resource allocation and business model optimization through changes in consumer demand, thereby promoting the continuous iteration of the industrial ecosystem. In the current integrated development of the paddleboarding and water sports industries in China, there are issues such as imbalanced resource allocation, severe homogenization of business formats, 'last-mile' problems in policy implementation, and weak technological innovation capabilities, which restrict the overall effectiveness of the industrial ecosystem.

Constructing a Health Promotion Framework for Adolescents: A Vitality-Oriented Approach within the Integration of Sports, Education, and Healthcare

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Abstract: This study addresses the declining physical fitness, prominent mental health issues, and the trend of chronic diseases affecting younger populations among adolescents. In response to the national strategies of "integration of sports and education" and "Healthy China," it aims to break down barriers between the sports, education, and health systems. The goal is to establish a new model for promoting adolescent health that integrates sports, education, and healthcare, with a core focus on "vitality-oriented" principles (including robust physical vitality, positive psychological vitality, and harmonious social vitality), thereby providing a pathway for systematically addressing adolescent health challenges.

The study first deconstructed the concept of "vitality" through literature analysis and developed an initial framework. Following a Delphi expert consultation ($n=22$), the model elements and collaborative mechanisms were refined. Pilot action research was conducted at a secondary school, implementing comprehensive interventions including: developing a school-based "vitality literacy" curriculum (integrating physical education, health education, psychological activities, and physical fitness monitoring); forming an interdisciplinary "health mentor team"; establishing digital health records and feedback mechanisms; and

optimizing the campus environment, with a control school set up for comparison. Data were collected using standardized tools (e.g., PedsQL, SCL-90), physical fitness tests, behavioral observations, interviews, and document reviews. Quantitative analysis was performed using SPSS, while qualitative thematic analysis was conducted with NVivo to achieve triangulation of verification.

A theoretical framework and "Four-Dimensional Integration" operational model have been successfully established, grounded in deep collaboration among physical education, sports, and healthcare to enhance three-dimensional vitality. The framework features: 1) Target-oriented dimension with measurable "vitality index"; 2) Curriculum activity dimension developing a three-tiered curriculum system; 3) Support guarantee dimension establishing cross-disciplinary teams and collaborative platforms; 4) Monitoring evaluation dimension forming a diversified assessment system. Practical validation demonstrated remarkable outcomes: Intervention schools showed 18.7% higher excellent endurance running rates ($p<0.01$) and significantly reduced new myopia incidence ($p<0.05$). PedsQL scores and emotional/social functioning showed significant improvement ($p<0.001$), while SCL-90 anxiety/depression scores decreased markedly ($p<0.01$). Daily moderate-to-high-intensity activity compliance increased by 23.5%, healthy dietary adherence improved, and peer support and campus belongingness strengthened ($p<0.05$).

This study demonstrates that the health promotion model developed under the framework of deep integration of physical education and healthcare, with the overarching goal of systematically enhancing adolescents' "vitality," possesses a solid theoretical foundation and

significant practical effectiveness. By breaking down disciplinary barriers, integrating high-quality resources, and innovating curriculum and service systems, this model effectively addresses the multidimensional needs of adolescent health in physiological, psychological, and social adaptation aspects. It achieves precision and systematic health promotion, serving as a powerful approach to tackle current complex health challenges.

It is recommended to strengthen policy coordination and top-level design among education, sports, and health departments, clarify legal status and resource allocation standards; establish a national core framework and encourage school-based innovation; invest in building "health mentors" and interdisciplinary training; deepen data-driven health management platforms and home-school-community linkage strategies; ensure long-term investment and establish third-party evaluation mechanisms to track cost-effectiveness and long-term outcomes. This model provides a new paradigm for youth health promotion and offers theoretical and practical support for deep collaboration and innovation in the physical education, sports, and health systems, as well as the implementation of the "Healthy China" strategy.

Key words: Health Promotion Framework; Adolescents; Vitality-Oriented Approach; integration of sports, education, and healthcare

Study on the Integration and Development Strategies of Physical Exercise and Elderly Care Industry against the Background of Aging Population

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Abstract Objective In the contemporary era, the global demographic structure is undergoing unprecedented and dramatic changes, and the socio-economic landscape is developing at a rapid pace. Against this backdrop, addressing the issue of population aging has emerged as a common concern highly focused on by all sectors of society and also a significant social challenge that urgently needs to be overcome. Given the current situation, China is experiencing an accelerating aging process, with the "silver-haired" wave sweeping in. In this context, the deep integration of physical exercise and the elderly care industry offers a new and innovative path to tackle challenges such as sports socialization, the social security system, and medical resources arising from the growing elderly population. It is conducive to enhancing the physical and mental health and quality of life of the elderly, thereby promoting healthy aging and driving the silver economy.

Methods This paper mainly employs the literature review method and logical analysis method. Firstly, by consulting relevant research findings both domestically and abroad, it sorts out the current research status of population aging, physical exercise, and the development of the elderly care industry, and identifies the shortcomings of existing research. Secondly, combining policy documents and statistical data, it

systematically summarizes the practical experiences and typical problems in the current integrated development of physical exercise and the elderly care industry in China. Finally, using logical deduction and comparative analysis methods, it conducts an in-depth exploration from aspects such as value motivations, constraints, and path selection, aiming to provide theoretical support and practical references for promoting the deep integration of physical exercise and the elderly care industry.

Results The study finds that physical exercise serves as a practical motivation for meeting the healthy elderly care needs of the elderly, improving their quality of life and sense of happiness, and driving innovation and upgrading in the elderly care industry. However, the integration of physical exercise and the elderly care industry faces constraints such as weak integration awareness, a mismatch between service supply and actual demand, and a lack of professional talent standards. **Conclusions** Firstly, at the policy guidance level: Formulate scientific and operable policies, strengthen the forward-looking nature and systemic integrity of top-level design, further increase financial support, continuously improve industry standards for the elderly care industry, and clearly define relevant requirements such as industry norms and quality to lay a solid foundation for the high-quality development of the elderly care industry. Secondly, at the industry synergy level: Actively promote the deep integration of the sports industry and the elderly care industry, establish a long-term development mechanism, facilitate the mutual exchange of resources and information, break down information barriers, and form a favorable development pattern to jointly address the severe challenges brought by population aging. Finally, at the service innovation level: Vigorously develop personalized exercise prescriptions,

guided by meeting the personalized and diverse health needs of the elderly. Fully consider factors such as the physical condition, health goals, and exercise preferences of the elderly to tailor scientific and reasonable exercise plans for them, thereby enhancing their enthusiasm and initiative in participating in physical exercise and improving their quality of life and health level.

Keywords: Aging Population; Physical Exercise; Elderly Care Industry; Integration and Development Strategies

Investigation and Research on Marine Environmental Awareness of Recreational Diving Experiencers

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Abstract: Objective Since the first proposal of the "Ocean Power" strategy in the report of the 18th National Congress of the Communist Party of China, President Xi Jinping has made a series of important remarks on marine ecological environmental protection, emphasizing that "building a ocean power is an important part of China's socialist cause." The report to the 20th CPC National Congress noted that we should develop the marine economy, protect the marine ecological environment, and expedite the building of a strong maritime country. Under the guidance of a series of policy documents, the research enthusiasm and intensity on the current situation, monitoring, governance and legal system of the Marine environment have continued to rise. However, the Marine awareness of the Chinese people still needs to be improved and enhanced. Therefore, this paper takes recreational diving experiencers at Fenjiezhou Island in Hainan Province as the survey subjects and will propose appropriate recommendations based on the survey results. The aim is to continuously enhance public attention and participation in marine environmental protection, and to establish a new pattern of co-construction, co-governance, and co-sharing in marine ecological conservation.

Methods Literature Review Method: Utilizing platforms such as academic journal databases to collate and summarize relevant literature, providing theoretical research ideas and foundations for this study. Questionnaire Survey Method: Based on the research objectives and significance, questionnaire items were supplemented and refined on the basis of previous research findings. The questionnaire was divided into four dimensions: marine environment knowledge, marine environment perception, marine environment emotion, and marine environment behavior tendency, totaling 12 items. The Questionnaire Star app was used to randomly distribute the questionnaires online, with offline guidance provided. A total of 230 questionnaires were distributed to recreational diving participants at Fenjiezhou Island, and 230 were collected. After excluding invalid questionnaires, 220 valid questionnaires were retained, resulting in an effective rate of 95.65%. Mathematical Statistics Method: Data were organized using Excel and subsequently analyzed with SPSS 25.0 for independent samples t-test.

Results In the analysis of the differences in Marine environmental awareness between genders, there were significant differences in Marine environmental perception and Marine environmental emotion ($p < .05$), while there were no significant differences in Marine environmental knowledge and behavioral tendencies. In the analysis of the differences in Marine environmental awareness among family regions, there were significant differences in Marine environmental knowledge, Marine environmental perception, and Marine environmental emotion ($p < .05$), while there were no significant differences in Marine environmental behavioral tendencies. In the analysis of the differences in Marine environmental awareness from recreational diving experiences, there

were significant differences in Marine environmental perception, Marine environmental emotion, and Marine environmental behavioral tendency ($p <.05$), while there was no significant difference in Marine environmental knowledge. In the analysis of the differences in Marine environmental awareness caused by occupational associations, there were significant differences in Marine environmental knowledge, Marine environmental perception, Marine environmental emotion and Marine environmental behavioral tendency ($p <.05$).

Conclusions In terms of gender, the focus and motivation of men and women participating in recreational diving experiences are slightly different, and there are significant differences in their perception of the Marine environment and emotions. However, due to the tremendous efforts made by our country in the formulation of Marine environmental protection policies, school education, scientific research, and social media publicity in recent years, there are no significant differences between different genders in terms of Marine environmental knowledge and behavioral tendencies. In the family area, coastal and inland divers, due to differences in geographical environment, cultural background, economic development strategy, etc., are reflected in the breadth, depth and speed of their access to Marine environmental knowledge. Understand the significance of the quality of the Marine environment to economic development and the quality of life; There are significant differences in emotional connection and sense of responsibility towards the ocean, which leads to remarkable differences in knowledge, perception and emotion regarding the Marine environment. Both inland freshwater resources and Marine resources are confronted with similar ecological environment protection and some common pollution sources. Therefore,

there is no significant difference in the tendency of Marine environmental actions. During recreational diving experiences, those who have such experiences will form multi-sea environment evaluations and be able to trigger emotional values in different sea areas, actively promoting the willingness to participate in the Marine environment and consolidating long-term behavioral intentions. Conversely, for those without experience, their evaluation of the Marine ecological environment is at an idealized and single-level level. Their emotions will gradually shift from novelty to anxiety, and their behavioral tendencies are short-term impulses, making it difficult to change deeply rooted behavioral habits. Therefore, there are significant differences in their perception of the Marine environment, emotions, and behavioral tendencies. And thanks to China's high regard for the Marine environment, there is no significant difference in Marine environment knowledge between those with or without recreational diving experience. In terms of professional connections, it is mainly reflected in the fact that frequent interaction and communication with people engaged in marine-related occupations can enable one to acquire more vivid and detailed professional knowledge. Maintain a sharp sense of observation and rational thinking when looking at problems, and form a scientific awareness of evaluation. Enhance environmental awareness and a sense of responsibility; Active participation leads to more sustained and long-lasting behavior. Therefore, there are significant differences in Marine environmental knowledge, perception, emotion and behavioral tendencies.

Suggestion In the future, virtual reality (VR technology) and artificial intelligence (AI technology) should also be applied to create highly interactive and realistic virtual Marine environments of different

sea areas, and enhance the intelligent experience of technology. At the same time, expand the breadth and depth of Marine knowledge and gradually enhance the public's awareness and willingness to consume. Revitalize inefficient sea areas, carry out ecological transformation, restore and maintain Marine ecology, and develop green Marine industries; Promote the development of Marine sports industry, Marine cultural experience activities, etc., shift from sightseeing and entertainment to responsibility and commitment, and enhance emotional connection. Finally, under the guidance of national policies, with the multi-dimensional support of technological empowerment and interaction, the reconstruction of the education system, the integration of cultural values, and institutional guarantees, we will continuously promote the coordinated development of the Marine economy and ecological protection, consolidate the long-term willingness to actively participate in Marine environmental protection, and achieve the sustainable development goal of "harmony between humans and the sea".

Keywords: Recreational diving; The Marine environment; Environmental awareness

Study on the Dilemma of Interdisciplinary Talent Shortage and Cultivation Paths in Community Sports and Health Centers

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Abstract To meet the strategic requirements of "integration of sports and healthcare" and the development of grassroots sports service capabilities outlined in the 15th Five-Year Plan for the Development of Sports Undertakings, this study focuses on the core issues in the development of community sports and health centers (CSHCs), and conducts an in-depth analysis of the underlying causes of existing contradictions at the systemic level, particularly addressing problems such as the imbalance between the supply and demand of talents in CSHCs. On this basis, it strives to construct a comprehensive mechanism integrating policy coordination, educational supply, and incentive guarantees, aiming to provide a theoretical basis for improving the talent policy system of CSHCs and practical, operable pathways for the implementation of relevant policies.

This study comprehensively employs the methods of literature review, questionnaire survey, interview research, and policy text analysis to investigate the dilemma of the shortage of interdisciplinary talents in CSHCs. The research results show that on the demand side, there is a capability gap between the upgrading of basic health services and the knowledge structure of talents, with only a small number of in-service personnel possessing both sports guidance and basic medical skills; the

existing talent pool exhibits a one-sided knowledge bias—sports workers hold sports skill certifications but have limited grasp of basic medical knowledge, while most medical staff hold clinical practice qualifications and only a small proportion have received training in exercise intervention.

On the supply side, traditional education models suffer from disciplinary barriers: the vast majority of universities offering physical education (PE) and sports rehabilitation programs have not incorporated basic medical knowledge courses into their PE curricula, and sports medicine only exists as an elective course in medical colleges with low student coverage. There is also a mismatch in practical training: internships for PE majors are concentrated in schools and gyms, with few involving community health managements; medical internships focus mainly on hospital clinical practice, with limited community-based experience (mostly health education rather than hands-on exercise intervention).

In terms of policy coordination and incentive mechanisms, policies related to the integration of sports and healthcare involve three departments (sports, health, and education), but most documents do not specify cross-departmental collaboration mechanisms, leading to difficulties in resource integration. In terms of remuneration, the average salary of community sports workers is lower than that of rehabilitation physicians in hospitals; the monthly subsidies for basic medical staff who also serve as sports instructors are far from covering their time costs, and there are limited career advancement paths.

Through an analytical framework encompassing three dimensions (demand, supply, and institutions) and integrating perspectives from

communities, universities, and job positions, the following conclusions are drawn: the upgrading of community health services has led to an upgrading of capability demands, but talent reserves have lagged behind; the "disciplinary silo" effect in the education system has intensified, with low curriculum overlap between sports colleges and medical schools; practical training scenarios are disconnected from the actual needs of communities, resulting in a lack of interdisciplinary capabilities.

Corresponding suggestions are put forward as follows: First, establish a three-level competency framework (primary, intermediate, and advanced), wherein the primary level requires basic capabilities such as fundamental sports guidance and blood pressure/glucose measurement, the intermediate level enables the formulation of exercise prescriptions for chronic diseases based on patients' conditions and the conduct of first-aid treatment, and the advanced level involves the ability to build health data models for community members and provide interventions for patients with multiple comorbidities. Second, implement university reform initiatives: PE-related majors shall make basic medical courses compulsory; medical colleges shall add practical courses on exercise intervention and establish community- based practice cooperation bases, where students are required to complete hands-on tasks such as formulating exercise prescriptions and conducting exercise intervention training. Third, encourage medical colleges and sports universities to jointly offer dual-degree programs in medicine and sports rehabilitation; promote talent mobility (e.g., rehabilitation physicians from hospitals and PE teachers from universities giving lectures in communities); and entrust universities to train students oriented to work in communities upon graduation.

Survey on the Employment Status of Graduates from Asian Diving College

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Abstract Objective The Ministry of Education formulated and implemented the *National Standards for the Teaching Quality of Undergraduate Programs in Sports Science (2018)*, which holds significant importance for deepening the comprehensive reform of undergraduate programs in sports science and further improving the quality of talent cultivation. In 2013, the Asian Diving College of Lingnan Normal University was established. At that time, relying on the Zhanjiang Diving School of the General Administration of Sport of China, it was in a leading position domestically. The talent cultivation program had a high proportion of course hours directly related to diving, and the systematic and structured approach to diving talent cultivation provided a comparative advantage in China. The employment positions for graduates of the Asian Diving College were primarily oriented towards the recreational diving market. By investigating the current employment situation of the program, this study analyzes existing employment issues to provide references for the sustainability of professional talent cultivation.

Methods The research primarily used questionnaire surveys and interviews. The questionnaire survey was distributed to graduates of the Asian Diving College from the past five academic years (2021–2025). The total number of graduates over these five years was 177, with 110

questionnaires collected via Questionnaire Star, of which 105 were valid, resulting in an effective rate of 95.5%. Semi-structured interviews were conducted with two groups: First, an interview outline was designed for the theme of practical teaching research, with three experts related to practical teaching in talent cultivation being interviewed. Each interview lasted 20–30 minutes. Second, an interview outline was designed for the same theme, with two students from each of the 2021–2025 graduating classes being interviewed. Each interview lasted 15–20 minutes. Key information was recorded during the interviews to prevent data loss, and the interview materials were organized after each session.

Results The survey data show that the highest proportion of employment positions is in sports training (45.61%). However, most graduates are engaged in work related to swimming training. Specifically, 31.58% of graduates work in schools, 10.53% work in government departments, and 12.28% work in other organizations. While 94.74% of respondents obtained relevant certifications (such as PADI, CMAS, etc.), only 14.04% of graduates are engaged in work related to diving. Currently, only 15 graduates from the past five years are employed in the diving sector, which is "far from" the program's training objective. Although the recreational diving market in Sanya is growing rapidly and has strong demand for recreational diving talent, the proportion of Asian Diving College graduates employed in diving enterprises remains relatively low.

Conclusions The survey identified the following reasons affecting graduates' employment in recreational diving enterprises:(1) High work intensity and pressure. The job requires physical stamina, and employees must deal with various emergencies, testing their sense of responsibility,

emergency response ability, and patience. With the implementation of the "one person, one code" system and star ratings, instructors' service quality is under more transparent supervision, requiring them to maintain high standards consistently. (2) Relatively low wages that are disproportionate to the labor invested. Employment positions mostly follow a "base salary + commission" model, with a clear hierarchy. Assistant instructors earn a monthly salary of approximately 5,500–6,500 yuan, while experienced instructors can earn a comprehensive monthly salary of 10,000–15,000 yuan. However, seasonal fluctuations significantly impact income. (3) Enterprises prefer versatile talent. In addition to recreational diving skills, individuals with skills such as motorboating and surfing, and those capable of taking on management roles, are particularly scarce.

Keywords: Graduate Employment; Asia Diving College; Multi-skilled Talent

Study on Mechanism Innovation and Practical Paths of Collaborative Training for Innovative and Entrepreneurial Talents in the Sports and Health Industry

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Abstract At present, under the combined influence of continuous policy support, the increasing demand for health services driven by an aging population, and the growing public awareness of health, the deep integration of the sports and health industries is experiencing significant development opportunities. Meanwhile, this integration trend also reveals a structural shortage in talent supply: the market urgently needs a group of cross-disciplinary talents who not only master sports science theories and are familiar with health management practices but also possess innovative thinking and entrepreneurial capabilities. However, the current talent cultivation system still faces practical challenges such as obvious disciplinary barriers and insufficient integration of industry and education.

This study adopts a research method combining case analysis, literature review, and logical analysis to systematically examine the current status and key issues of cultivating innovative and entrepreneurial talents in the sports and health field, and further explores the mechanisms and practical paths for their cultivation. Through these explorations, it aims to contribute theoretical basis and practical solutions for building a talent cultivation system in the sports and health industry that meets domestic needs, thereby effectively supporting the advancement of the

"Healthy China" strategy and the development of the sports industry to a higher quality stage.

The study summarizes three main innovative mechanisms. (1) The multi-subject collaborative education mechanism integrates the resources and advantages of different subjects to form a synergy in talent cultivation. ① The most common form of multi-subject collaboration is the school-enterprise collaboration, which mainly includes the joint construction of talent cultivation bases, enterprise participation in course development, and the provision of targeted employment positions. Such collaboration not only expands students' practical platforms but also effectively shortens the matching time between talents and positions, thereby enhancing their employment competitiveness. ② School-local collaboration, as another important form, covers multiple aspects such as the co-cultivation of sports talents, the joint construction of innovation and entrepreneurship, the exchange of visiting enterprises and job exploration, and the joint promotion of industrial development. Through the combination of event linkage, resource sharing, and the off-campus mentor system, it promotes the complementary advantages among local institutions, universities, and enterprises, achieving a win-win situation for all parties. (2) The project-driven collaborative teaching mechanism emphasizes the integration of real industrial projects into the teaching process, closely combining theoretical knowledge with practical application, and cultivating students' comprehensive ability to solve complex problems while promoting the transformation of scientific research achievements into industrial applications. (3) The dynamic feedback-based evaluation and incentive mechanism focuses on the two-way interaction between evaluation and incentives. ① The

evaluation system needs to integrate three dimensions: terminal, process, and self-evaluation. The traditional terminal single academic performance evaluation cannot fully reflect the effect of collaborative cultivation, and it is necessary to establish a process evaluation system covering multiple dimensions such as knowledge mastery, ability improvement, and innovation achievements, and incorporate students' self-evaluation and reflection. ②The incentive mechanism should take into account both spiritual and material aspects to stimulate the enthusiasm of all subjects in collaborative cultivation. For students, innovative practice can be encouraged through the recognition of innovation and entrepreneurship credits and support for outstanding project incubation. For teachers and enterprise mentors, a cross-disciplinary appointment and achievement recognition mechanism should be established, such as including collaborative cultivation achievements in the evaluation system for professional titles and performance appraisals to enhance their participation enthusiasm.

Innovative mechanisms need to be realized through specific practical paths. (1) By reconstructing the curriculum system, balance "guidance" and "openness", use "blank space questioning" to stimulate students' thinking, while controlling the boundaries of discussion. (2) Practical teaching, as an important carrier, needs to organically combine course content with project practice, and strengthen students' application ability through platforms such as subject competitions. (3) Build a high-level "dual-qualified" teaching team, and enhance teachers' capabilities through specialized training and school-enterprise exchanges. At the same time, pay attention to the construction of innovation and entrepreneurship teams, clarify role positioning, member selection, and division of labor

and cooperation. (4) Reform the traditional evaluation system, introduce a positive incentive mechanism that focuses on the development process, adopt a multi-subject participation evaluation method, and incorporate students' comprehensive performance in innovation practice and teamwork into the evaluation standards, thereby forming a comprehensive and objective measurement system.

Research on Diving Event Brand Building

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Abstract With the popularity of diving worldwide, diving activities, including diving competitions, have become increasingly numerous. A brand is a strategic goal in modern society. For diving activities to be held long-term and continuously enhance their influence and value, brand development and establishing a diving activity brand represent an excellent path. Based on existing theories of sporting event brand building, this paper explores the brand development of diving activities through case analyses of world-famous competitions and large-scale diving events.

Brand building for diving activities first requires establishing a brand symbol system for diving activities, which includes three constituent elements: the brand symbol of diving activities, the brand culture of diving activities, and high-quality diving activities. The brand symbol is a specific visual expression of diving activities, commonly referred to as a LOGO, which is quite common in most long-term diving activities; To build a brand, diving activities must be high-quality experiences that satisfy all participants and spectators, thereby gaining long-term supporters and the possibility of sustained development. Diving activities are not just events themselves; they also carry certain cultural values. The development of diving activities is an important source of the brand culture of diving activities, requiring long-term accumulation to clearly present the core values and unique character that

the diving activities aim to convey. High-quality diving activities, their brand symbols, and the brand culture they embody and express form the brand symbol system of diving activities, which is the foundation for the survival and development of diving activity brands.

Diving activities that have established a brand symbol system, in order to develop in the market and gain more support and participation, must engage in marketing to realize the social and economic value of diving activities. The marketing of diving activities should take brand culture as the core, aim to build good relationships with participants and supporters, and adopt the principle of integrated marketing, Make full use of television, online media, social media, and self-media to promote the brand value and activities of diving, expand the popularity of the diving activity brand, strengthen connections with supporters and participants, accurately and effectively communicate the diving activity brand, and accumulate and enhance the brand assets of diving activities.

The operation and management of a diving activity brand require a bold and visionary leader to establish strategic goals for the long-term development of diving activities, build a cohesive and effective organization to implement the brand's strategic plan, maintain the brand image of diving activities, and enhance and fulfill the brand equity of diving activities.

Therefore, the branding development path for diving activities first involves the emergence of a leading figure who proposes a brand plan for diving activities and establishes an effective operational organization; secondly, it requires improving the quality of diving event hosting to satisfy all supporters and participants as much as possible; Third, improve the brand symbol system of diving activities, materialize the development

history of diving activities, and clarify the brand culture of diving activities; fourth, market the brand culture of diving activities, maintain the unified image of the diving activity brand, enhance the popularity and reputation of the diving activity brand, and continuously improve and monetize brand assets.

Research on the Current Situation and Countermeasures of “Integration of Sports and Medicine”in Primary and Secondary Schools in Chongqing from the Perspective of “Healthy China”

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¹

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Abstract Objective The “Healthy China 2030” blueprint proposes to “improve the physical fitness of the whole people by extensively promoting nationwide fitness, strengthening the integration of sports and medicine and non-medical health interventions, and promoting physical activities for key populations”。 This elevates the “Integration of Sports and Medicine”to the level of national policy for the first time, promoting the interconnection and integration of sports science with medical rehabilitation. From the perspective of “Healthy China” and in conjunction with the compulsory education “Physical Education and Health Curriculum Standards” (2022 edition), this study investigates the current state of health education in primary and secondary schools in Chongqing, analyzes existing problems in the “Integration of Sports and Medicine”, explores its deficiencies and causes, and proposes targeted solutions. The aim is to provide a scientific basis for implementing the “Healthy China” strategy and establishing effective youth sports and

health promotion programs.

Methods Literature review, expert interviews, logical analysis.

Results Subjective Attitudes of Faculty: The vast majority of faculty believe that the “Integration of Sports and Medicine” is highly significant, particularly for enlightening and practicing sports and health promotion among young students. However, health education is rarely implemented in physical education teaching, failing to meet the relevant requirements of the "Integration of Sports and Medicine" and youth sports and health promotion. Understanding of Scientific Mechanisms: Overall, there is a significant imbalance in faculty's cognition, understanding, and practical application of the five aspects of the “Integration of Sports and Medicine”: scientific mechanisms, applicable situations, basic processes, constituent parameters, and precautions. This indicates a need for further improvement. Implementation Capacity for Health Education: Faculty primarily conduct health education around the “Physical Education and Health Curriculum Standards” to help young students develop healthy and safe behavioral norms and attitudes towards life. However, a gap remains compared to the youth sports and health promotion requirements of the “Healthy China 203” blueprint. Material Foundation: A lack of appropriate classroom space and related equipment is a major factor restricting primary and secondary school physical education teachers from carrying out health education.

Conclusions: Awareness of “Sports-Medicine Integration” in Chongqing's primary and secondary schools is insufficient, and there are misconceptions about the scientific nature of exercise intervention, resulting in it being prioritized in rhetoric but marginalized in practice. Due to a lack of systematic research connecting the "Healthy China

2030" Plan Outline and the "Physical Education and Health Curriculum Standards," implementing "Sports-Medicine Integration" in physical education teaching is difficult, and instructional practices often remain superficial. The absence of professional collaborative training involving primary/secondary schools and the medical rehabilitation field hinders the sustained and in-depth development of "Sports-Medicine Integration" health education. The lack of venues, facilities, and teaching equipment for "Sports-Medicine Integration" is a significant factor constraining its implementation.

Suggestions Strengthen publicity and education on "Sports-Medicine Integration" to enhance recognition across society. Establish a collaborative health education mechanism for "Sports-Medicine Integration" in primary and secondary schools to promote efficient youth sports and health promotion. Continuously intensify the cultivation of interdisciplinary talents for "Sports-Medicine Integration" and improve the teaching workforce across all relevant fields. Sustainably increase funding to ensure the provision of "Sports-Medicine Integration" health education courses.

Keywords: Healthy China; Sports-Medicine Integration; Chongqing Primary and Secondary Schools; Current Situation and Countermeasures

Theme 3

**AI Empowers the Massive Health and the Innovation
and Development of Exercise**

Methodology for Monitoring Technical and Speed-Strength Preparedness of Rowing Athletes Using Modern Intelligent Systems

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Аннотация The article discusses a methodology for assessing and monitoring the technical and speed-strength fitness of athletes specializing in kayaking and canoeing. The methodology is based on the use of portable strain gauges and a complex of wireless surface electromyography.

Введение The current stage in the development of sports science is characterized by the active introduction of innovative technologies aimed at enhancing the accuracy of monitoring and analyzing the training process of athletes. One of the most promising areas is the use of intelligent sensor systems that objectively record and analyze biomechanical, dynamic and energetic parameters of movements. In kayaking and canoeing, where the effectiveness of equipment and the level of speed and strength training directly determine the effectiveness of competitive activities, the use of such systems becomes a necessary tool for scientific control and management of the training process [1].

The effectiveness of rowing is due to a complex interaction of

technical, coordination and strength factors that require accurate quantification. In the context of flatwater rowing, an athlete operates without a fixed point of support, which complicates the biomechanical structure of movements and places special demands on the rationality of interaction with water, oar and boat. Not only the speed of the boat, but also the efficiency of all motor activity depends on the optimal distribution of force and coordination of movements of various parts of the body [2]. Therefore, the control of technical and speed-strength training of rowers should be based on a comprehensive measurement system that ensures the registration of key movement parameters in real time and their subsequent analytical interpretation.

One of the main tasks of the modern athlete training is to create an objective monitoring system that allows tracking the dynamics of an athlete's technical skill and functional readiness. To solve this problem, intelligent sensor systems based on the principles of strain measurement and inertial motion analysis are used. Their use provides an opportunity to obtain reliable data on the strength and timing characteristics of the stroke, the amplitude of movements, rhythm and performance of the athlete [3].

Тензометрические датчики в безуклонной гребле The most promising direction in the development of technical readiness monitoring tools is the use of portable strain gauges based on microelectromechanical technologies (hereinafter referred to as MEMS). Such sensors allow you to register the mechanical effects that occur when the paddle interacts with the surface of the water when performing a stroke. These interactions are converted into electrical signals, which are then processed by the sensor's hardware and software. The design of the strain gauge includes an elastic metal element with a glued strain gauge connected to the recording unit by

means of specialized PDC wires providing power and data transmission.

Strain gauges can be used in both wired and wireless configurations. The wired circuit provides a high recording frequency (up to 1000 Hz) and minimizes data loss, which is especially important when conducting scientific research. The wireless configuration, on the contrary, has greater mobility and convenience when used in the training process, allowing the trainer to receive real-time operational feedback.

An important element of the measuring complex is the data recording unit, which synchronizes several sensors, controls the recording process, stores and transmits information to external media. For the correct operation of the system, the config.ini configuration file is used to set parameters such as the sampling frequency, the number of active channels, calibration coefficients and other settings. This architecture ensures system flexibility and adaptability to specific research goals and objectives.

Процедуры калибровки и регистрация данных To ensure high measurement accuracy, a mandatory procedure for hardware calibration of strain gauges is carried out. It is carried out in conditions that simulate real loads, in which the paddle is fixed on two supports, and a calibration weight is applied to the blade. Using this procedure, the system records the indicators of the "zero" and "loaded" states of the paddle, forming a calibration curve for each strain gauge. If necessary, manual calibration is used to make adjustments in case of unforeseen changes in the registration process.

After calibration, the paddle with attached strain gauges is used by the athlete during the test tasks. Data is recorded at a high frequency, which makes it possible to record the smallest fluctuations in force and

load dynamics within the reference and unsupported phases of each stroke [4]. The data obtained are time series subject to noise caused by mechanical vibrations of the paddle shaft and the influence of external factors. To eliminate them, a moving average filter is used to smooth out digital distortions while maintaining the information content of the signal [5].

At subsequent stages, the data is processed automatically using the specialized software "Rowing Locomotion Analyzer". This software allows you to visualize signals, identify individual strokes, calculate biomechanical parameters, and create individual athlete protocols. The main parameters of the analysis include: maximum and average blade load (F_{\max} , F_{av}), stroke support time (t_{sup}), tempo (T), rolling length (L_{av}), speed-force index (J), stability coefficient (K_{st}) and stroke density index ($p=F_{\text{av}}/F_{\max}$), characterizing the propulsive efficiency of movements [6].

Электромиография в оценке рациональности движений
Strain gauges provide registration of the external mechanical parameters of the stroke, however, for a complete analysis of the technique and the speed and strength potential of the athlete, it is necessary to study the inner side of motor activity – neuromuscular coordination. The most informative method in this area is surface electromyography (hereinafter referred to as EMG), which allows determining the sequence and amplitude–frequency characteristics of bioelectric activity of large muscle groups of athletes [7].

Modern wireless electromyographic complexes, such as Delsys Trigno Avanti, are equipped with inertial measuring units (hereinafter referred to as IMUS), which record the amount of acceleration, rotation characteristics and spatial orientation of the athlete's body or its individual

parts relative to the Earth's magnetic field. The frequency of registration of bioelectric activity signals reaches 4000 Hz, which makes it possible to analyze the quantitative features of muscle activity, as well as the sequence of muscle activation. Based on the EMG data, patterns of interaction between the muscles of the shoulder girdle, back and legs are revealed, which makes it possible to optimize the distribution of forces and increase the efficiency of transferring the resulting force to the paddle.

Our research has shown that the maximum effort during rowing is accompanied by a change in intermuscular coordination through the activation of the largest muscle groups. However, the features of changes in intermuscular coordination largely depend on the pace of rowing and the distance covered. At short competitive distances, small muscle groups (biceps muscles of the shoulder, large and small round muscles of the back) usually demonstrate the greatest bioelectric activity. This is due to the ability of such muscles to contract rapidly and maintain a high rate of movement, but for a short time. When overcoming longer distances, the pace of athletes' movements is usually much lower, the boat rental per stroke is longer, the exposure time to the water surface during the support phase of the stroke is longer, which creates opportunities for the use of larger muscle groups and, as a result, the development of significantly greater propulsive forces. Thus, the use of EMG in combination with strain gauge systems makes it possible to obtain a comprehensive picture that combines the external and internal aspects of an athlete's motor activity.

Заключение The integration of intelligent sensor systems into the rowing training process represents a significant step in the development of modern sports diagnostics. The use of strain gauges based on MEMS

technologies ensures high-precision recording of the mechanical characteristics of the stroke in natural conditions of training sessions. This makes it possible to quantify the effectiveness of an athlete's interaction with water and identify the structural features of his technique.

The combination of strain measurement with EMG forms an integrated approach in assessing the external and internal aspects of the motor activity of rowers. Electromyographic analysis reveals the patterns of work of the leading muscle groups, the dynamics of their activation and intermuscular coordination in various phases of the stroke, which allows an objective assessment of the rationality of movements. The combined use of these technologies helps to identify individual patterns of motor activity and adjust training effects, taking into account the biomechanical and neurophysiological characteristics of the athlete.

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Improving the Chess Selection System Using the Chess & Brain Computer Program

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Abstract This article examines regulatory documents for improving the chess selection system, using examples from global chess powers. It addresses the challenges of chess selection at various stages of long-term training. The "Chess&Brain" computer program is presented as a diagnostic tool for chess selection.

Sports selection is a fundamental component in the training of elite athletes. Chess selection primarily involves considering the specific intellectual abilities of athletes (chess memory, mental performance and attention span). The need to improve the sports selection system is driven by increased global competition and the significant rejuvenation of the sport.

The aim of the study is to analyze the sports selection systems in chess among world powers and improve the system for the sports selection

of chess players using the Chess&Brain computer program. A number of global chess powers have developed regulatory documents to improve the sports selection system. The program for the development of the sport of chess in the Russian Federation for the period 2025-2028 includes the clause "Creating a unified system for selecting the most talented athletes for education and training at federal and regional athlete training centers." In the Republic of Uzbekistan, the "Roadmap" of the State Program for the Development of Chess until 2025 is being implemented. A key aspect of the roadmap is the radical improvement of the system for the selection and selection of highly talented young chess players. Due to the quantitative lag of strong Chinese juniors compared to world-class juniors, a plan for the development of Chinese chess talent for 2022–2032 has been developed. The plan includes: the use of scientific and advanced concepts for organizing the selection of the reserve, the development of a standardized selection system for juniors and regular testing of talented chess players [1].

The high achievements of Chinese chess players on the global stage are due to the successful implementation of a system for training elite athletes. Studying and analyzing this training system allows us to identify the key components of Chinese chess players' success. Certainly, the achievements of Chinese chess players are often attributed to their high level of work ethic and persistent daily training. The chess mastery of highly skilled athletes is virtually identical; therefore, the outcome of a game depends on competitive potential, psychological resilience and physical condition. The model for training chess talent in China includes three stages. Stage 1: organizing classes within educational institutions (creating chess clubs). Stage 2: conducting training in specialized chess

clubs, which are often organized by highly skilled chess players who have retired from competitive chess. This stage forms a reserve for the national team. Stage 3: training process for the national team [2].

In the Republic of Belarus, the selection process is problematic due to the lack of objective diagnostic tools and methods for assessing a player's potential in chess. Therefore, we developed the "Chess&Brain" computer program as a diagnostic tool for assessing a player's potential. The program includes 6 specific tasks. The computer program was tested in the Republic of Belarus and the Republic of Uzbekistan. The identified correlations between the test exercise results and the players' skill levels confirmed the specificity of the developed exercises.

The "Squares" exercise includes 6 difficulty levels (from 4 to 9 squares). Instructions: remember the locations of the highlighted squares in 5 seconds and then find them. The number of correctly found squares is counted. The "Squares Sequence" exercise involves memorizing squares as they appear (6 difficulty levels – from 4 to 9 squares). The number of correctly found squares in the required sequence in 5 seconds is counted. In the "Pieces" exercise, you must memorize the locations of the pieces on the chessboard in 5 seconds and then arrange them in their correct positions (10 difficulty levels – from 3 to 16 pieces). The "Squares," "Squares Sequence" and "Pieces" exercises allow to assess visual memory and board vision. The "Piece Moves" exercise involves holding and moving chess pieces in your mind depending on the appearance of squares. Instructions: click on a piece that can move to the highlighted square. The athlete's task is to remember 40 moves of pieces (3 pieces), if 3 mistakes are made, the exercise is stopped. Depending on the difficulty level, the number of pieces increases. The number of moves and the time spent on

completing the exercise are taken into account. Exercise "Opening 1" – remember the sequence of moves at the beginning of the game (theoretical opening lines). At the first difficulty level, there are 10 moves for white and black. The greatest number of memorized moves and the time of execution are recorded. The sequence of moves is displayed on the program screen (level 1 – 1. d4 Nf6 2. Nf3 d6 3. c4 g6 4. g3 Bg7 5. Bg2 O-O 6. O-O Nc6 7. Nc3 e5 8. dxe5 dxe5 9. Bg5 Be6 10. Qc1 Qc8). The chess player must indicate the chain of moves in the correct sequence. Athletes who successfully memorized 10 moves advanced to Level 2 (memorizing 20 moves). The "Opening 6" exercise requires memorizing a random sequence of moves at the beginning of a game. For example, the level 1 sequence of moves is: 1. d4 g5 2. Nc3 f6 3. f4 a5 4. Nf3 g4 5. Nh4 h6 6. e4 d5 7. Bd3 Nc6 8. Bd2 e5 9. f5 Nge7 10. Qe2 b5 [3]. The developed computer program "Chess&Brain" allows us to determine the learnability of athletes for chess during preliminary sports training and identify specific predispositions for chess.

The issue of improving the system of sports selection in chess is addressed in a number of regulatory documents at the state level. The developed computer program "Chess&Brain" is an objective diagnostic tool for determining the potential of an athlete in chess at the early stages of long-term sports training.

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Smart Sports: Digital Transformation and Artificial Intelligence in Chess and Esports

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Abstract This article explores the phenomenon of digital transformation in sports, defined as "smart sports." Using chess and esports as examples, it analyzes the impact of artificial intelligence (AI) technologies and digital platforms on all aspects of the sports system: from athlete training and refereeing to spectator experience and commercialization.

Introduction Modern sports are undergoing fundamental changes initiated by the digital revolution. The concept of "sport" is no longer limited solely to physical activity. The intellectual component, enhanced and transformed by digital technologies, is becoming increasingly important. This phenomenon can be described as "smart sports" – an ecosystem in which the processes of generating, processing, and using data become a key factor for success.

The most striking examples of "smart sports" are esports (video game competitions) and chess. While esports originally emerged in the digital environment and is its product, chess represents a unique case of a centuries-old activity that has undergone a complete and profound digital transformation. An analysis of these two seemingly distinct fields reveals universal patterns in the impact of artificial intelligence and digital platforms on sports practice. The way these technologies open new

horizons for the popularization of chess and its integration into educational processes deserves special consideration.

The aim of this article is to analyze the directions and consequences of digital transformation in chess and esports, highlighting the role of artificial intelligence as a catalyst for change and to assess the prospects for the popularization and educational application of chess.

A key aspect of "smart" sports is the transition from training based on the coach's experience and intuition to data-driven strategy. In chess, this transition has been marked by the emergence and widespread adoption of chess engines (e.g., Stockfish, Leela Chess Zero) – programs based on AI algorithms whose playing power far exceeds that of humans. These engines have fundamentally changed the approach to analysis and training:

After each game, grandmasters analyze it using an engine that instantly evaluates positions and identifies missed tactical and strategic opportunities. This allows them to identify systemic errors rather than simply state the result. AI is used to analyze the opening repertoires of future opponents. Specialized software (such as ChessBase) can process thousands of games, identifying typical patterns, player strengths and weaknesses and thus formulating a customized strategy.

Opening theory development is no longer the result of years of discussions between grandmasters, but rather through engine calculations. AI generates and evaluates new, often non-obvious, moves, deepening and complicating theoretical preparation. In esports, the processes are similar, but the tools used are somewhat different. Analytics platforms (e.g., for Dota 2 and Counter-Strike) are also used here to study match statistics. Trackers collect data on player movement on the map, shooting accuracy,

ability use and reaction time. This allows for a quantitative assessment of the effectiveness of each action. AI and machine learning are used to analyze teamplay patterns and identify the most successful strategies (hero picks/bans, tactics) against specific teams.

Thus, in both chess and esports, athletes become "data operators," whose success directly depends on their ability to effectively interact with analytics systems. Digital transformation has had a decisive impact on chess's return to the mainstream and has unlocked its enormous educational potential. This impact manifests itself in several key ways.

The emergence of online platforms such as Chess.com and Lichess.org has made chess accessible to millions of users worldwide. These platforms have adopted best practices from the worlds of esports and game design: Built-in learning systems, rankings, puzzles and daily challenges make learning chess engaging.

The rise in popularity of rapid and blitz chess, which are better suited for online viewing and match the pace of the modern digital environment, has contributed to its popularity. Chess streamers on Twitch and YouTube, such as Hikaru Nakamura, demonstrate that chess can be spectacular and entertaining. They comment on their games, interact with the audience, and use visual effects, making chess accessible and appealing to a younger generation raised on esports.

Digital tools and AI are fundamentally changing the approach to chess teaching: adaptive algorithms on educational platforms can analyze a student's strengths and weaknesses, selecting individual sets of exercises to practice specific skills (tactics, strategy, etc.).

Online platforms erase geographical and economic barriers. Children from anywhere in the world can access high-quality educational materials

and play against opponents of their own skill level. The digital rating system (ELO) allows for visual and objective tracking of student progress, which is a powerful motivator. Students can independently analyze their games using chess engines, which develops critical thinking and self-learning skills. This transforms chess from a simple game into a powerful tool for developing cognitive abilities – logic, memory and strategic planning.

Thus, digitalization is transforming chess from an elite activity into a mass, accessible and effective educational tool that meets the challenges of the digital age. Digitalization has radically changed both the administrative and organizational aspects of the sport, as well as its perception by spectators. In chess, this has been most clearly demonstrated in the fight against cheating. The problem of players using chess engines during games (so-called "cheating") has become one of the most pressing. To address this, complex AI algorithms are being used to analyze player moves in real time and compare them with the engine's recommended moves. Furthermore, digital platforms have automated tournament organization, rating systems and pairings, making competitions global and accessible.

Online broadcasts of chess tournaments, equipped with graphics showing AI position evaluations in real time, have made the complex game accessible to a wider audience. Viewers no longer simply observe the movements of pieces but receive expert assessments of the situation, increasing engagement. This brings chess closer to esports, where similar systems provide a wealth of data for viewers.

Conclusion The analysis conducted allows us to conclude that chess and esports are models of "smart" sports. Despite their different natures,

they demonstrate similar trajectories of digital transformation, driven by artificial intelligence and big data processing. Digitalization has affected all elements of the sports system, and in the case of chess, it has taken them to a fundamentally new level of development.

Chess, having evolved from an ancient game to a digital "smart" sport, demonstrates how the symbiosis of tradition and innovation can not only preserve but also greatly enhance the relevance of an intellectual discipline in the modern world.

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Conceptual Model of an Integrated Ai-Based Information and Analytical System for Sports Training (Case Study of Handball)

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Abstract The paper substantiates the concept of an integrated information and analytical system (IIAS) for managing the training process of handball players based on artificial intelligence. The model comprises data collection modules, a scientific knowledge base, an analytical core, and an AI assistant. The system integrates and analyzes a multitude of diverse data, enabling coaches to make informed and timely decisions.

The relevance of digitalization in sports and the adoption of artificial intelligence technologies is confirmed at the highest state level, including in the Republic of Belarus, where the development of digital technologies and AI is recognized as the top priority for scientific activity for 2026-2030 [1]. This aligns with a global trend where data becomes a key asset for gaining competitive advantages. In team sports, and especially in handball, this process is of critical importance due to the extreme complexity and multifaceted nature of the sport itself [2].

Modern handball is characterized by high intensity, the necessity to maintain peak physical condition during a long season, and increasing competition [3]. Researchers note that coaches and specialists must

simultaneously consider numerous interrelated factors: physiological load on the cardiovascular and musculoskeletal systems, differentiated loads based on playing position, technical and tactical aspects alongside the dynamics of game episodes, spatial patterns and cognitive loads, as well as high risks of injury and the need to manage the psychological state of athletes [4, 5, 6].

Current approaches to analyzing this data are often fragmented and not integrated into a unified system, which hinders the making of prompt and evidence-based management decisions. Thus, there is an objective need to create a holistic system capable of aggregating, analyzing, and interpreting heterogeneous data, transforming it into practical recommendations. The aim of this work is to develop a conceptual model of an integrated information and analytical system for handball based on artificial intelligence.

The conceptual model of the proposed IIAS is based on the principles of integrity, adaptability, and continuous self-learning. Its architecture comprises four key interconnected modules, forming a closed-loop management cycle for training: from data collection to the generation of personalized recommendations.

1. Data Collection and Integration Module.

This module is responsible for multi-channel acquisition of information from heterogeneous sources. These include:

Technical monitoring tools: GPS trackers, IMU sensors (inertial measurement units), computer vision systems for analyzing movement and biomechanics, sensor systems for assessing physiological load parameters.

Technical and tactical performance indicators: video data from matches and training sessions with subsequent automated processing to

assess the effectiveness of offensive and defensive actions, shot accuracy, number of interceptions, etc.

Psychological and cognitive tests: results from regular athlete questionnaires and testing to assess stress levels, motivation, and cognitive functions.

External data: statistics on game performance from national and international databases.

The module's task is to ensure automated aggregation and primary normalization of data, creating a unified digital environment for subsequent analysis.

2. Scientific and Methodological Information Base.

This component is a structured knowledge repository. It includes: automatically parsed academic databases (Scopus, Web of Science, etc.) based on key queries related to handball and sports science, a repository of successful methodologies and training programs from leading world clubs and national teams, analytical reports on major international tournaments (World and European Championships). This module provides a link between the empirical data collected by Module 1 and modern scientific knowledge, providing context for its interpretation.

3. Analytical Core based on Artificial Intelligence and Machine Learning.

This is the central and most complex component of the system. Based on aggregated data, it addresses the following tasks:

Development of ideal models: creating generalized models of players in different positions and teams based on the analysis of data on leading world athletes.

Predictive analytics: forecasting individual and team performance,

risks of overtraining, and probability of injuries based on identifying hidden patterns in historical data.

Personalization: developing dynamically adaptable training programs considering the athlete's current functional state, their playing position, competition calendar, and monitoring data.

Tactical analysis: automated assessment of the effectiveness of game schemes and generating recommendations for their optimization against specific opponents.

4. AI Assistant with Natural Language Interface.

This module serves as the system's user interface for coaches, doctors, and analysts.

It allows: formulating queries in free-text form (e.g., "indicate the most vulnerable zones in team Y's defense"), receiving ready-made analytical reports and visualizations, and systematically receiving automatically generated warnings and recommendations (e.g., about the need to reduce load for a particular athlete).

The crucial property of the entire system is its ability for continuous self-learning. As new data accumulates, the machine learning algorithms are retrained, increasing the accuracy of predictions and the reliability of recommendations, transforming the IIAS from an analytical tool into a self-improving decision support ecosystem.

Thus, the implementation of the proposed conceptual model will overcome the fragmentation of existing approaches to training handball players. The practical application of the IIAS is expected to yield significant socio-economic benefits by providing clubs and national teams with access to top-level data analysis technologies without the need to maintain a large staff of highly specialized analysts.

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Application of Artificial Intelligence in Language Teaching

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Abstract This article analyzes the application of Artificial Intelligence (AI) in foreign language education for non-linguistic university students. It identifies key areas such as learning personalization, the creation of adaptive materials, and access to authentic digital media, demonstrating how AI serves as a tool to automate routine tasks and enhance student engagement.

Artificial intelligence (AI) tools are fundamentally transforming traditional approaches to organizing professional activities, educational processes, communication, healthcare, and tourism. Within the field of education, AI has become a significant resource, especially in the context of teaching and learning foreign languages.

AI can be used for developing curricula and creating educational content. It serves as a valuable source for working with authentic materials and developing specialized tasks that consider learners' proficiency level, age characteristics, and individual preferences.

The goal of the research is to analyze the capabilities of AI in teaching a foreign language to students of a non-linguistic higher education institution.

Materials and research methods Theoretical and empirical research methods were used in writing this article. An analysis of scientific and methodological literature dedicated to the use of artificial intelligence in education was conducted, and AI services were analyzed for their functionality and potential for integration into the foreign language teaching process.

Teaching English is the most common area of AI application in the educational sphere [1]. The potential of AI for improving teaching methodologies and enhancing the efficiency of the educational process appears significant. Its implementation contributes to the optimization of pedagogical activities and creates conditions for the individualization of the learning process. The modern paradigm of language education is undergoing radical changes under the influence of artificial intelligence technologies. Traditional teaching methods are giving way to cognitive-constructivist models, where AI tutors act as catalysts for learning personalization [2].

The key areas of AI application in language education include:

1. Personalization of Learning. AI allows for the adaptation of learning materials to the individual needs of learners. Machine learning algorithms analyze data on learner progress, identify their weaknesses, and suggest personalized tasks. This is especially important in heterogeneous groups.

2. Creation of Adaptive Learning Materials. AI is capable of generating learning materials that correspond to the level and interests of learners. This includes simplifying and complicating original texts, creating exercises, and developing interactive tasks. Such materials make the learning process more engaging.

3. Use of Digital Media. AI facilitates access to authentic materials, such as articles, videos, and audio recordings, which promotes immersion in the language environment. This is particularly important for developing listening and reading skills [3].

Considering the advantages of AI for teachers, the following can be highlighted: reduction of time spent on lesson preparation and assignment checking; the possibility of using AI to create exercises of varying difficulty levels; AI helps teachers focus on more creative and intellectual aspects of teaching. Regarding the advantages of AI for learners, it should be noted that students can use AI for independent practice of language skills (speaking, writing, reading, listening); AI provides personalized tasks and feedback, which contributes to more effective learning; through interactive and adaptive technologies, student motivation increases.

Currently, the modern paradigm involves key aspects:

1. Re-evaluation of Didactic Principles: transition from standardized to adaptive learning; individualization of educational trajectories; formation of “digital learning ecosystems.”

2. Change in the Role Structure of the Educational Process: the teacher becomes a “designer of the educational experience”; the student acts as an active co-creator of the learning process; the AI assistant is perceived as a “cognitive amplifier” [2].

At the present stage, the role of the teacher in foreign language instruction remains leading, as it is they who structure the lessons and select the methodology for conducting them.

Next, we present an overview of some platforms that can be used by teachers in preparing and conducting foreign language classes:

1. The DeepSeek neural network is a powerful AI assistant based on Large Language Models (LLM), designed for text generation (answers questions, writes articles, code, analyzes data), information processing (works with documents: PDF, Word, Excel, etc.), learning, and assistance (explains complex topics, helps with research). Its advantages over other AI assistants that can be used in the Republic of Belarus include: operation without a VPN (Virtual Private Network); free access; support for long context (up to 128K tokens); the ability to upload files for analysis.

2. Perplexity AI is an intelligent search platform based on AI, which combines generative language models (LLM), semantic search of academic and web sources, a citation system, and data verification. The distinctive features of this tool are: answers with cited sources (academic articles, authoritative websites); a clarifying dialogue mode (refining queries in real time); multimodality (working with text, tables, code). As practical recommendations for using this resource, the examples as follows can be provided: “Provide examples of the usage of the word X in different contexts”, “Compare the use of the Present Perfect and Past Simple in articles from British sports media”, “Find the latest research on changes in French business sports etiquette.” There are also specialized tools focused specifically on foreign language teachers. Such AI tools include the platform twee.com, web.diffit.me, as well as the Google Chrome extension called Brisk Teaching for interactive learning, which we will examine in more detail.

3. The Brisk Teaching extension allows for working with video and text materials for use in foreign language classes. For example, when opening a video needed for the educational process, such as on YouTube,

one can activate the “Brisk it” menu and select from a list of possibilities for working with this video, for instance, creating various tests; notes or an article; images and presentations; questions aimed at checking the depth of understanding of the studied material. The extension allows for working with text, for example, authentic articles. By opening the “Brisk it” menu, one can create classifications and scales for analyzing information from the text, and develop worksheet assignments for students.

Thus, AI tools are a significant facilitator of the teacher's routine tasks; however, they do not replace the teacher, requiring critical evaluation of sources, additional methodological processing of data, and consideration of the individual characteristics of study groups. Artificial intelligence offers tools for personalizing learning, automating feedback, and creating adaptive materials. However, successful implementation of AI requires a balanced approach, considering both technological capabilities and the role of the teacher.

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Artificial Intelligence Empowers the Reform of Physical Education in Higher Education: Logical Pathways, Typical Scenarios, and Limitations

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Abstract Objective Against the dual backdrop of the "Healthy China 2030" strategy and educational digitalization, physical education in higher education faces practical challenges such as a singular teaching model, rigid evaluation systems, and uneven resource distribution. This study aims to systematically explore the logical pathways, typical application scenarios, and limitations of artificial intelligence technology in empowering the reform of physical education in higher education. The goal is to promote the transformation of physical education courses from "skill training" to "literacy cultivation," providing theoretical foundations and practical references for the modernization of physical education in higher education.

Methods This study employs a combination of theoretical analysis and case studies. By reviewing empowerment theory and its application in the field of education, a three-dimensional interaction model of "objective-technology-subject" was constructed to explain the core logic of AI-enabled physical education teaching. Practical application cases of technologies such as smart wearable devices, VR/AR, and big data were combined to summarize typical scenarios and analyze their limitations from technical, ethical, and educational perspectives.

Results and Analysis The study indicates that AI reconstructs the

"objective- content -evaluation" logical chain, driving three major transformations in physical education teaching: from experience-driven to scientific evidence-based, from skill-oriented to literacy-integrated, and from spatiotemporal limitations to lifelong learning. Typical application scenarios include: (1) personalized training and health management based on smart wearable devices; (2) immersive learning of motor skills supported by VR/AR technology; (3) data-driven intelligent evaluation and feedback mechanisms; (4) human-machine collaborative intelligent tutoring systems; (5) data platforms supporting course management and decision-making; and (6) interactive physical education promoting interdisciplinary integration. These scenarios significantly enhance the precision, interactivity, and comprehensiveness of teaching.

However, AI empowerment still faces multiple limitations: insufficient technological maturity and accessibility, particularly in universities in underdeveloped regions where resource distribution is uneven; prominent ethical risks such as data privacy and algorithmic fairness; lagging digital-intelligent literacy among teachers, with traditional teaching concepts struggling to adapt to technological changes; and policies, regulations, and societal acceptance lagging behind technological development.

Conclusions and Recommendations Artificial intelligence technology provides innovative pathways for the reform of physical education in higher education, facilitating personalized, precise, and literacy-oriented physical education. However, the risk of technological alienation must be guarded against, avoiding the trap of "data fetishism." The following recommendations are proposed to advance the reform: First, strengthen tiered teacher training to enhance their application skills

in digital-intelligent technologies and educational. Second, develop lightweight, low-cost technological tools to promote balanced resource allocation. Third, build a collaborative "society-school-enterprise" ecosystem to drive policy adaptation and standard development. Fourth, strengthen ethical oversight to ensure data security and algorithmic transparency. Future research could focus on areas such as the construction of AI-driven adaptive physical fitness models and the development of lifelong physical literacy evaluation systems, promoting the shift of digital-intelligent physical education from localized innovation to systemic change.

Keywords: AI Empowerment; Physical Education in Higher Education; Educational Reform; Logical Pathways; Typical Scenarios

Examining the Relationship Between Scientific Exercise and Active Health in the Smart Era: The Case of Chinese Society

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Abstract Research Background: With China's rapid socioeconomic development and the widespread penetration of smart technologies, scientific exercise knowledge has become increasingly accessible, and exercise intervention methods continue to diversify. However, in stark contrast, key indicators of national physical fitness (such as college students' physical fitness test scores) show a declining trend, while the onset age of chronic diseases continues to decrease. This "health paradox" reveals deep-seated challenges in the current technology-driven model of promoting scientific exercise, prompting us to reflect: Why do health outcomes decline rather than improve despite the increasing sophistication of exercise science?

Problem Analysis This study posits that the root cause lies not in insufficient scientific knowledge about exercise, but in the alienation of social culture and individual mindsets shaped by the intelligent era. Drawing on Simmel's discussion of how monetary economies neglect spiritual needs and Zhuangzi's philosophy opposing "cunning minds" (i.e., crafty and utilitarian thinking), this paper argues that the excessive convenience brought by intelligent technology is fueling the prevalence of utilitarianism, consumerism, and instant gratification. This mindset erodes the intrinsic value of exercise, reducing it to a mere expedient tool for acquiring health (an external outcome) rather than an integral part of

daily life aimed at achieving mind-body harmony as an internal purpose and practice. Consequently, individuals tend to pursue “high-efficiency, quick-fix” exercise regimens, neglecting exercise's essence as a lifestyle habit and life experience. This leads to unsustainable exercise behaviors, preventing the realization of its long-term health-promoting effects.

Research Methodology This study employs qualitative research methods, constructing a critical analytical framework of “technological rationality - ideological concepts-health outcomes” through theoretical analysis and philosophical reflection. This framework aims to dissect how the smart technology environment ultimately undermines the role of scientific exercise in promoting proactive health by influencing individuals' value perceptions and behavioral motivations.

Research Findings (1) True health encompasses not only the optimization of physiological states but also the health and clarity of ideological concepts. The critical bottleneck in current health challenges lies in the alienation of ideological concepts, not the absence of scientific exercise principles. (2) To resolve the “health paradox,” the scientific exercise paradigm must transition from “instrumental rationality” to “value rationality.” This entails reestablishing the intrinsic value and purpose of exercise itself, viewing health as a natural “byproduct” of this practice. (3) The fundamental pathway to this transformation lies in infusing physical exercise with profound cultural significance and spiritual value. By exploring and integrating indigenous cultural elements (such as the philosophical principles embedded in martial arts), individuals can develop enduring intrinsic motivation that transcends utilitarian goals. This ensures the sustainability of scientific exercise and ultimately achieves genuine proactive health.

Keywords: Intelligent Era; Scientific Exercise; Proactive Health

The Path Exploration of Artificial Intelligence Empowering the National Fitness Public Service System

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Abstract Research Purpose As a strategic technology driving a new wave of scientific and technological revolution and industrial transformation, artificial intelligence is increasingly integrating into the field of national fitness public services, providing endless momentum for innovative and leapfrog development in the supply of such services. In response to current bottlenecks in supply efficiency, precision, and resource balance within national fitness public services, this study explores the integration pathways of artificial intelligence with the national fitness public service system by leveraging the technical advantages of AI. It clarifies the application scenarios of artificial intelligence in service supply, resource allocation, and scientific guidance, offering theoretical and practical references for advancing the system toward intelligent and inclusive transformation, thereby supporting the implementation of the Healthy China strategy.

Research Methods Literature review, logical analysis.

Findings and Analysis The current national fitness public service system exhibits three prominent issues: First, there is a mismatch between service supply and demand, where generalized services struggle to meet the personalized needs of different groups, resulting in insufficient coverage of targeted fitness guidance. Second, resource allocation efficiency is low, characterized by imbalanced usage of public sports

facilities-underutilization during some periods coexists with shortages during peak hours. Third, scientific fitness support is weak, as community-level services lack systematic analysis of user exercise habits and demonstrate inadequate professional guidance. Artificial intelligence technology demonstrates significant potential in addressing these challenges: By integrating multi-dimensional information through intelligent algorithms, it can accurately identify the fitness needs of different demographic groups and enable dynamic adjustments to service provision. Through smart scheduling systems, it optimizes the allocation and usage of public sports facilities, thereby reducing resource waste. The application of AI-assisted tools enhances the accessibility of scientific fitness guidance, with particularly noticeable effects at the community level.

Conclusions and Recommendations (1) Enhance age-friendly and inclusive technological adaptations by developing simplified interfaces with features such as large-text displays and voice interaction. Leverage community activity centers to provide training on the use of smart tools, with a focus on improving technology acceptance among middle-aged, elderly, and rural populations, thereby effectively narrowing the digital divide. (2) Establish a unified national fitness data-sharing platform, formulate standardized data collection protocols, and clarify the boundaries for the use of exercise and health information. Simultaneously, implement data encryption and privacy protection mechanisms to safeguard user information security. (3) Promote the deep integration of AI technology with grassroots service scenarios. Equip community fitness stations with intelligent monitoring devices and integrate AI coaching systems to provide real-time movement correction and health

risk alerts, making professional guidance readily accessible. (4) Develop a collaborative mechanism guided by the government, driven by corporate R&D, and supported by social participation. Encourage the development of low-cost intelligent service tools and reduce barriers to grassroots adoption through subsidy policies, ensuring that technological empowerment reaches all populations. The ultimate goal is to build a national fitness service ecosystem characterized by intelligent support, equitable coverage, and sustainable operation.

Research on AI Empowered Sports Health Management Platform Construction from the Perspective of Healthy China Initiative

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Abstract Objective The "Healthy China 2030 Initiative" guideline clearly points out that China needs to strengthen innovation in health technology, build a health information service system, and promote the application of health and medical big data. In recent years, AI technology, as an amplifier of the value of big data, has continuously empowered the construction of sports and health management platforms.

Methods This study comprehensively uses literature review and expert interview methods, focusing on the application scenarios of AI in sports and health management platforms, and proposes targeted optimization solutions based on the challenges in its application process.

Results The study found that AI is widely used in sports and health management platforms, with deep applications in various sports scenarios such as youth sports, elderly care, mass fitness and wearable devices, professional training and competitive sports, sports medicine integration, and risk screening, mainly involving four aspects. One is the collection and analysis of exercise data: AI collects real-time exercise data such as heart rate, step frequency, posture, and exercise trajectory of users through computer vision, wearable devices, sensors, and other means, and combines big data algorithms for analysis to generate personalized exercise reports and training recommendations. The second is health risk

prediction and intervention: AI can conduct exercise risk assessment based on users' historical health data, real-time physiological indicators, and environmental factors, and provide warning and intervention suggestions. Thirdly, personalized exercise prescriptions and rehabilitation guidance: AI platforms can automatically generate personalized exercise prescriptions based on users' physical fitness, health goals, exercise preferences, etc., and dynamically adjust them during the execution process. The fourth is the intelligent referee and examination system: In sports exams and events, AI is used for automatic scoring, violation recognition, and examination supervision, improving fairness and efficiency. At the same time, the construction of AI enabled sports and health management platforms faces issues such as data privacy protection and security, balance between model universality and personalization, lack of emotional support and human-machine collaboration, and technical misjudgment and responsibility attribution.

Conclusion and Suggestions The application of AI technology in sports and health management platforms has shifted from basic data collection to complex and high-end intelligent decision-making. It has achieved significant results in data collection and analysis, risk warning, personalized intervention, exam supervision, etc. However, breakthroughs are needed in data security, model adaptation, human-machine collaboration, ethical norms, and other aspects. Based on this, the following optimization suggestions are proposed: firstly, data security should shift from passive compliance to active governance, and the platform should establish a hybrid computing architecture of local and edge computing, with sensitive data not uploaded to the cloud; Introducing federated learning, model training does not require the

original data to be out of domain; Adopting a combination of facial blurring and skeleton point extraction mode for image and video data, achieving dual desensitization. Secondly, the model needs to shift from single point customization to hierarchical reuse, constructing a dual layer architecture of sports big model and small scene fine-tuning: the bottom layer adopts a universal big model, and the upper layer uses a small amount of scene data for fine-tuning. The third is to address the issue of poor manual collaboration. A hybrid model of AI and manual can be adopted, where AI is responsible for data analysis and manual provides psychological debugging and complex problem handling. The fourth is to focus on ethical fairness and adopt a dual track mechanism between humans and machines. AI judgments are marked first, and the referee confirms the judgment. At the same time, AI error indicators are made public to visualize the AI decision-making path and accept public supervision.

Keywords: Healthy China Initiative; AI; Sports Health Management; Dilemmas and Suggestions

Research on the Current Situation, Dilemmas and Path Reconstruction of Smart Technology Empowering Physical Education Teaching in Primary and Secondary Schools

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Research Objectives Against the backdrop of rapid digital development, the Ministry of Education has continuously advanced policies on sports informatization. Smart devices have gradually integrated into physical education (PE) classes in primary and secondary schools, becoming an important tool for teachers to conduct scientific teaching. However, there are still many challenges in practical application. This paper focuses on the current application status of smart technologies in primary and secondary school PE teaching and explores their enabling paths. By analyzing core problems in practice—such as conflicts between smart technologies and traditional teaching concepts, insufficient data literacy of teachers, and hidden risks of data privacy and security—it proposes targeted practical strategies: promoting the green transformation of teaching models, systematically improving teachers' data literacy, and building a closed-loop mechanism of "promoting teaching through evaluation". These strategies aim to provide theoretical support and practical references for primary and secondary school PE teachers in applying smart technologies.

Research Methods 1. Literature Review Method: Sort out relevant domestic and international literature and policies, clarify the current research status, analyze opportunities and challenges, and lay a

theoretical foundation. 2. Case Study Method: Select primary and secondary schools that apply smart technologies, conduct classroom observations and teacher interviews, analyze dilemmas, and extract replicable experiences. 3. Questionnaire Survey Method: Design questionnaires for relevant PE teachers, collect feedback, conduct statistical analysis, and provide empirical support for the conclusions. 4.

Interdisciplinary Research Method: Integrate theories from education, sports, artificial intelligence (AI), big data and other disciplines, conduct multi-dimensional analysis of integration logic, and enhance the depth of the research.

Research Results 1. Practical Research on Smart Technology Empowering PE Teaching in Primary and Secondary Schools

(1) Constraints of Traditional Teaching Concepts: Some PE teachers still rely on traditional teaching models, question the application value of smart technologies, and even have a resistant attitude, making it difficult for technologies to deeply integrate with teaching practice.

(2) Shortcomings in Teachers' Data Literacy: Most PE teachers lack systematic data processing and analysis capabilities. Faced with the massive data generated during teaching, they cannot effectively extract key information and convert it into a basis for teaching decisions.

(3) Cost Pressure of Smart Technology Application: The introduction of smart technology equipment such as AI in primary and secondary schools requires high procurement and maintenance costs. Schools generally face funding pressure and are also concerned about the actual teaching benefits of technology investment.

(4) Security Risks of Data Privacy: In the whole process of collecting, transmitting, storing and using students' sports data, there is a

lack of sound security protection mechanisms, and there are hidden risks of privacy and security such as data leakage and abuse.

2. Practical Paths of Smart Technology Empowering PE Teaching in Primary and Secondary Schools

(1) Transformation of Teachers' Roles: From movement demonstrators to data interpreters. PE teachers need to break through the single positioning of movement demonstration, improve data interpretation capabilities, and formulate accurate and personalized teaching and training plans for students by analyzing information such as students' physical fitness and skill weaknesses behind their sports data.

(2) Upgrading of Teaching Logic: From experience-driven to data-driven. Abandon the traditional teaching model that relies on teachers' experience, and take students' sports data collected by smart technologies as the core to accurately match students' diverse needs. Smart technologies do not replace teachers, but use data-based methods to achieve accurate positioning of teaching goals and dynamic adjustment of the process, thereby improving students' PE learning experience and teaching effects.

Research Conclusions 1. Promoting the Green Transformation of PE Teaching is an Inevitable Trend: Under policy guidance, smart technologies have become a core driving force for reforming PE teaching in primary and secondary schools. They promote teaching to shift from experience-driven to data-based precision, from passive acceptance to active exploration and experience, and from summative evaluation to process-oriented value-added evaluation—fully demonstrating the inevitability of integrating technologies with PE teaching. It is necessary to actively promote the green transformation of teaching through digital

empowerment and effectively improve the quality and efficiency of PE classes. 2. Improving Teachers' Data Literacy is a Core Premise: The profound impact of smart technologies on various industries extends to the field of education. Improving PE teachers' data literacy is not only a core requirement to adapt to the digital transformation of education, but also an important prerequisite for realizing the precision, personalization and scientificization of PE teaching, which directly determines the actual effect of technology empowerment. 3. Building a Closed-Loop of "Promoting Teaching through Evaluation" is a Key Path: In the digital age, smart technologies have broken the temporal and spatial limitations of traditional PE evaluation, turning evaluation from the end of teaching into the starting point. By building a closed-loop mechanism of "data feedback - strategy optimization - effect improvement", the goal of "promoting teaching through evaluation" is effectively implemented, helping PE teaching return to the original intention of teaching students in accordance with their aptitude.

Research on the Practical Application and Challenge Response of AI Empowering Elderly People's Sports and Health Promotion

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Abstract Objective As the process of population aging continues to deepen, the health issues of the elderly have drawn increasing attention from all sectors of society. Sports health promotion, as an effective way to improve the quality of life of the elderly, has been given new impetus by artificial intelligence (AI) technology. This study focuses on the specific practical application of AI technology in promoting the sports health of the elderly, and mainly analyzes the positive effects of AI in optimizing the sports participation experience of the elderly, enhancing physical functions, and improving overall health levels. At the same time, the study will identify the main challenges and constraints in current applications and propose targeted solutions accordingly, in order to promote the scientific integration and long-term development of AI technology in the field of elderly sports health. Development.

Methods Through the literature review method, we sorted out relevant studies to understand the current status of AI research and application in the field of elderly health; using the case analysis method, we selected some successful cases where AI technology was applied to promote the physical health of the elderly for in-depth analysis, summarizing their experiences and practices; by using the induction and summary method, we classified and categorized the challenges

encountered in the AI application process and proposed corresponding solutions.

Results AI technology has established a preliminary systematic support system for the physical health of the elderly through motion monitoring, health warnings and personalized guidance. For instance, smart wearable devices can continuously collect physiological data and generate personalized exercise plans through algorithms, effectively improving the efficiency of health management and the scientific of exercise. However, the promotion and popularization of this technology still face three constraints: (1) Low user acceptance: This is due to the inherent cognitive habits and insufficient understanding of the elderly, resulting in usage obstacles and resistance to complex intelligent devices. (2) Lack of product age- friendliness: Many existing AI devices fail to adequately consider the physical and mental characteristics of elderly users in their interface design (such as small fonts and information overload), artificially raising the usage threshold. (3) Data security and privacy concerns: Elderly individuals and their families have concerns about the security and usage of personal health data, which constitutes a key constraint on technological trust.

Conclusions AI can significantly enhance the promotion of elderly people's physical health and well-being, but it requires effective responses to the challenges it faces. Therefore, the following multi-dimensional coordinated development suggestions are proposed: (1) At the technical level, adhere to the "elderly-friendly" orientation: encourage the development of AI products that follow the principle of "Barrier Free Design", by simplifying operations, optimizing interfaces,

and strengthening voice interaction , to truly lower the threshold for technology use. (2) At the user level, implement popularization education: communities, families, and social organizations should collaborate to conduct digital technology training and humanistic care for the elderly, enhancing their confidence and ability in using technology. (3) At the guarantee level, build a "data security" defense line: establish strict , transparent , and reassuring data security and privacy protection mechanisms through technology and management to win trust. (4) At the social level , create an "inclusive support" environment : it is recommended that the government introduce incentive policies to guide industries, academia, and social forces to jointly participate, and build a favorable ecosystem to support the application of elderly health technologies.

Keywords: AI; Elderly; Sports health; Smart wearable devices; Data security

Research on AI-driven Exercise Prescription Generation and Health Management for the Elderly Population

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Abstract Objective With the accelerating global aging process, how to delay functional decline and improve the quality of life through scientific exercise has become a major public health issue. Traditional health management methods lack personalization and have lagging feedback. This study developed and validated an AI-driven personalized exercise prescription and health management system for the elderly, aiming to achieve precise, dynamic, and intelligent exercise intervention, and enhance the health benefits and safety of exercise for the elderly.

Methods 1. Literature review: To clarify the research status of artificial intelligence in the field of elderly sports health, this study conducted a comprehensive search and screening of authoritative domestic and foreign literature in the past five years, and summarized the key technologies and mainstream application models. 2. Experimental method: This study recruited 150 community-dwelling elderly people aged 65 and above as subjects and conducted a 12-week randomized controlled trial to evaluate its effects on improving physical function (such as SPPB score), improving physiological indicators (such as blood pressure, blood sugar), and enhancing life satisfaction. 3. Questionnaire survey method: After the controlled experiment, the subjects were given questionnaires to obtain the satisfaction of the elderly with the exercise plan, so as to optimize and adjust the exercise plan in the future.

Results After 12 weeks of intervention, compared with the control group, the experimental group using the AI-driven system showed significant improvement in all indicators ($p<0.05$). 1. Physical function: The average score of the simple physical performance scale of the elderly in the experimental group increased significantly more than that of the control group, especially in balance ability and walking speed. 2. Physiological indicators: The systolic blood pressure and fasting blood glucose values of participants with mild hypertension and diabetes in the experimental group decreased significantly. 3. Behavior and satisfaction: The continuous monitoring data of the system platform showed that the average compliance rate of the exercise plan in the experimental group reached 85%, significantly higher than 60% in the control group. The questionnaire survey and interview results indicated that the elderly had a higher acceptance of the "tailor-made" and "flexible adjustment" exercise plan, and their subjective happiness improved. The study believes that the core advantage of the AI model lies in its dynamic adaptability. It can adjust the daily exercise load according to the daily physical condition and fatigue level of the elderly, effectively avoiding the risk of over-exercise, which is incomparable to the traditional static prescription.

Conclusion This study confirmed that the exercise prescription generation and health management system based on AI technology can provide efficient, safe and personalized exercise health promotion plans for the elderly. This model realizes the large-scale and precise implementation of scientific exercise guidance through the "evaluation - generation - execution - feedback - optimization" closed loop. It is suggested to promote from three aspects: technically, integrate multiple data to improve the accuracy and interaction ability of the AI model;

application-wise, promote the integration with community medical care and family doctors to establish a regular "medical and sports integration" service; policy-wise, incorporate AI digital therapy into the elderly health system and improve data security and industry standards.

Keywords: The elderly; Artificial intelligence; Exercise prescription; Health management

Integrated application of artificial intelligence in sports health management: Opportunities, challenges, and future prospects

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Abstract Objective The rapid development of artificial intelligence (AI) technology has brought about a paradigm shift in the field of sports health management. This study aims to systematically examine the current status of AI integration and application in this field, accurately identify the revolutionary opportunities it brings and the practical challenges it faces, and outline the future development landscape based on this. It aims to guide the deepening and standardization of technology application, ultimately enhancing the efficiency and personalization level of sports health management for all.

Methods 1. Literature review: This study systematically retrieves, screens, and analyzes research literature on AI applications in the sports health field published in authoritative journals at home and abroad in the past five years, sorting out key technological paths and application models. 2. Case analysis: Four representative application cases are selected for in-depth comparative analysis, including a real-time motion correction system based on computer vision, a personalized exercise prescription generation platform utilizing machine learning algorithms, a chronic disease exercise intervention model combining wearable devices and AI, and a sports health data prediction and policy simulation system for large populations. By combining "macro-level analysis" and

"micro-level analysis," the research comprehensively grasps the opportunities, bottlenecks, and inherent logic of AI applications.

Results The study finds that AI brings three major development opportunities to sports health management. Firstly, relying on machine learning to integrate multi-source data, personalized exercise prescription generation and risk warning can be achieved, pushing health management from a "one-size-fits-all" approach to a "tailored for everyone" approach. Secondly, with the help of computer vision and sensor technology, real-time motion capture, analysis, and correction become possible, forming an ubiquitous "AI coach" and lowering the threshold for professional guidance. Thirdly, natural language processing and data mining technologies can automate the processing of massive health information, providing support for institutional resource allocation, effect evaluation, and public health policies. At the same time, this field also faces multiple challenges. In terms of data, there are issues of inconsistent quality and "data silos"; at the technical level, the "black box" nature of AI models weakens decision-making transparency, affecting professional trust, and the generalization ability of algorithms also needs to be improved; in addition, ethical governance issues such as privacy security, algorithmic fairness, and responsibility attribution are also prominent.

Conclusion The integration of artificial intelligence and sports health management is unstoppable, but it requires a leap from "instrumental application" to "systemic integration".

Suggestions First, promote interdisciplinary collaboration, focusing on key technologies such as data standardization and explainable AI; second, strengthen government guidance and build a regulatory system covering data security, algorithm auditing, and industry access; third, put

people first, optimize human-computer interaction, bridge the "digital divide", and ensure that technological development truly serves people's health.

Key words Artificial intelligence application devices; Wearable devices; Large models; Health management

Research on AI-Enabled Proactive Health Management

Paradigm for Occupational Diseases in Special Industries: A Case Study of the Hotel Industry

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Research Objectives Against the backdrop of the in-depth advancement of the "Healthy China" strategy and the widespread dissemination of the health-first philosophy, the health security of employees in special industries has become an increasingly prominent concern. As a typical representative of special industries, the hotel industry, due to the distinctive nature of its work, exposes its employees to multiple health risks, including musculoskeletal injuries, chronic fatigue, and psychological stress, thereby necessitating the development of effective health intervention measures. This study is designed to achieve three core objectives: firstly, to conduct a systematic assessment of the multi-dimensional characteristics and underlying causes of occupational diseases among hotel industry employees; secondly, to construct and validate the effectiveness of an AI-based personalized exercise training intervention model; thirdly, to formulate a set of digital technology-driven proactive health management paradigms and implementation pathways that can be extended to special industries, so as to provide theoretical and practical support for enhancing the health status of employees and advancing the digital transformation of health management models within the industry.

Research Methods This study employs the methods of literature

analysis and theoretical deduction. It systematically reviews existing research on the prevention and control of occupational diseases as well as exercise interventions in special industries, constructs a theoretical framework empowered by artificial intelligence, and deduces personalized health management pathways in the context of hotel industry work scenarios. These efforts collectively aim to provide theoretical underpinnings for the transformation of health management in special industries.

Research Results and Analysis Through systematic theoretical construction and deduction, this study has yielded three key findings: first, based on literature analysis, it accurately identifies the multi-dimensional health risk system faced by hotel industry employees, with musculoskeletal injuries, chronic fatigue, and psychological stress as the core components, and clarifies the intrinsic link between these risks and the work characteristics of special industries; second, it successfully develops a theoretical framework model of "AI-Enabled Proactive Health Management" that integrates functions such as intelligent assessment, AI-based prescription generation, real-time interactive guidance, and dynamic optimization, while systematically elaborating on the mechanism through which digital technology drives reforms in health management; third, it innovatively designs personalized exercise intervention implementation pathways and standardized protocols tailored to the specific work scenarios of the hotel industry, thereby providing a theoretically validated and highly feasible digital transformation paradigm for the prevention and control of occupational diseases in special industries.

Conclusions and Recommendations Artificial intelligence

technology is reshaping the traditional health management paradigm and offering a new approach to the prevention and control of occupational diseases in special industries. AI-driven health management achieves the transformation from "generalized and universal" to "precision and individualized" as well as from "passive response" to "proactive prevention" through three core mechanisms: data intelligence, algorithm matching, and real-time interaction, effectively addressing the shortcomings of traditional intervention measures. An analysis focusing on the hotel industry demonstrates that this approach can resolve issues such as inadequate targeting, low compliance, and weak sustainability.

Based on the above conclusions, three levels of recommendations are proposed: at the strategic level, industry authorities should incorporate AI-enabled health empowerment into the safety production standard system for special industries and promote the development of a new health governance model that emphasizes both "technological prevention and human prevention"; at the organizational level, enterprises are required to establish a three-in-one health management system encompassing "intelligent health risk monitoring, AI-based exercise prescription database, and human-machine collaborative training", thereby transforming employee health management from a cost center into a human capital investment; at the implementation level, it is necessary to develop lightweight AI health assistants adapted to the work scenarios of special industries, create immersive training courses based on VR/AR technology, and establish a dual mechanism for employee health digital profiles and privacy protection, so as to ensure that the application of technology is ethically sound and sustainable.

Cultural Hybridity and Health Identity in "China-Chic Workout" Consumption: A Machine Learning and Sentiment Analysis of UGC on Xiaohongshu

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Abstract Driven by the dual forces of cultural confidence and the Healthy China Initiative, "China-chic workouts"—characterized by integrating traditional cultural elements such as Tai Chi and Dunhuang dance — have gained widespread dissemination on platforms like Xiaohongshu, forming a unique consumption phenomenon. This study aims to decode the underlying logic of cultural hybridity, the mechanisms of health identity construction, and the pathways of consumption conversion, thereby providing theoretical guidance and policy insights for innovation in the sports culture industry.

We crawled user-generated content (UGC) tagged with five hashtags (e.g.,#China-chicWorkout, #ChineseStyleFat Burning) from Xiaohongshu between January 2023 and May 2025. Using the BERTopic model, we extracted cultural symbol themes and calculated a "Cultural Fusion Index" (C-Fusion Score). Sentiment polarity and arousal dimensions were analyzed via a fine-tuned RoBERTa-wwm-ext model. Combining machine learning-based structural equation modeling (ML-SEM) with propensity score matching (PSM), we tested the chained causal pathway: cultural hybridity→emotional response→health identity→consumption intention. Heterogeneity effects of gender, age, and traditional cultural engagement were further examined.

Results and Analysis (1) Topic modeling revealed that high-engagement posts universally integrated three symbolic clusters: traditional music + martial arts movements + Hanfu styling. Notably, posts combining Peking Opera gestures with HIIT received 37.6% higher average likes than pure fitness content. (2) Sentiment computation demonstrated that for every 1-standard-deviation increase in the C-Fusion Score, affective arousal rose by $0.42\sigma(\text{SD})$, and the proportion of positive polarity increased by 19.8%. This verifies the significant positive effect of cultural hybridity on emotional activation. (3) ML-SEM results indicated: Cultural hybridity significantly predicted affective arousal ($\beta=0.38$, $p<0.001$); Affective arousal subsequently strengthened health identity ($\beta=0.44$, $p<0.001$); The total effect of health identity on consumption intention was 0.46, explaining 54% of the total variance. This confirms the affect-identity pathway as the core mechanism driving consumption conversion. (4) PSM heterogeneity analysis identified the strongest marginal effects in: Female users ($\beta=0.52$); The 25–34 age cohort ($\beta=0.49$). (5) In terms of dissemination power, high C-Fusion posts exhibited a 19.4% average increase in bookmark rate (an indicator of content value). Additionally, behavioral terms like "follow-along workout" and "requesting music links" significantly surged in comments, indicating that cultural hybridity not only fosters identity but also triggers actionable consumption cues.

Conclusions and Recommendations (1) The dual-path model of "culture-emotion" for China-chic workouts is empirically validated. Online cultural hybridity enhances health identity through affective arousal, ultimately driving consumption and dissemination behaviors. This provides a replicable digital dissemination paradigm for the

modernization of traditional sports. (2) Strategic implications for stakeholders:Brands should dynamically integrate symbolic clusters of music-movement-attire, prioritizing high-arousal elements (e.g., traditional rhythms and martial arts imagery). Targeted campaigns should focus on female and young urban demographics.Platforms (e.g., Xiaohongshu) could establish dedicated traffic tags (e.g., #ChinaChicSports) to incentivize creators' symbolic innovation. (3) Regulatory and institutional actions:Supervisory bodies and sports associations should formulate Digital China-Chic Content Guidelines to prevent superficial/homogenized cultural symbols, ensuring scientific rigor and health-oriented expression. (4) Future research directions:Extend analysis to multi-platform data (e.g., Douyin, Bilibili) with physiological metrics (e.g., heart rate variability) and longitudinal tracking to examine long-term health behavior effects.Explore differential symbol activation across traditional sports (e.g., Tai Chi vs. Dunhuang dance) in digital scenarios, fostering deep integration of Chinese cultural heritage with the health industry.

Integrating AI-driven Personalized Learning with Student-led Innovation in Physical Education: A Practice-based Exploration of “Mutual Growth in Teaching and Learning”

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Abstract Objective With artificial intelligence (AI) increasingly integrated into education, teaching models and the roles of teachers and learners are undergoing transformation. This study aimed to explore how AI-driven personalized learning can be combined with the pedagogical philosophy of “mutual growth in teaching and learning.” Specifically, it investigated how students use AI tools to generate and refine new sports activities, experience and modify them, and then teach them to peers, thereby enhancing creativity, initiative, and collaboration while redefining the teacher’s role from instructor to facilitator.

Methods This action research adopted a five-step framework. First, students used AI to randomly generate sports activities, including rules and objectives. Second, they playtested and evaluated the activities. Third, teachers and students collaboratively discussed feasibility and modifications, reflecting a shift in the teacher’s role toward mentorship. Fourth, students designed teaching materials and assessment rubrics under teacher guidance. Finally, the refined activities were implemented through student-led clubs. Data were collected using a mixed-methods approach, including interviews with teachers and students and structured

evaluation scales. Both cognitive outcomes (knowledge mastery and instructional design quality) and affective-behavioral outcomes (creativity, collaboration, and engagement) were assessed.

Results The results showed that this model significantly improved students' learning initiative. Acting as both "designers" and "teachers," students demonstrated increased ownership of learning and deeper understanding of content. Through iterative cycles of critique and recreation, their problem-solving and creative thinking skills were strengthened. Teachers' roles transformed from knowledge transmitters to facilitators, supporting reflective learning through structured evaluation rubrics. The club-based implementation further enhanced peer learning and interdisciplinary collaboration. AI contributed by supporting personalized learning and expanding creative possibilities, though challenges such as impractical AI-generated designs, superficial outputs without sufficient guidance, and limited resources for sustaining clubs were identified.

Conclusions Integrating AI-driven personalized learning with the principle of "mutual growth in teaching and learning" holds strong potential for innovation in physical education. This model fosters student creativity, enhances teacher role transformation, and promotes active, student-centered learning. It is recommended that: (1) teacher training in AI tool integration be strengthened; (2) evaluation frameworks be refined to balance knowledge and skill development; (3) sustainability be promoted through integration into school-based curricula; and (4) interdisciplinary applications of this model be further explored across science, social studies, and the arts.

Key words: Artificial intelligence (AI); Personalized learning;

Physical education; Action research; Peer learning

Research and Application of Intelligent Physical Education in Primary Schools Based on AI Motion Image Analysis

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Abstract Adolescent physical health is the cornerstone of the "Healthy China 2030" strategy. As a key stage in cultivating lifelong exercise habits, the quality of physical education teaching is crucial. However, traditional physical education teaching faces challenges: it is difficult for teachers to pay close attention to the details of each student's movements accurately, and feedback is lagging and subjective; teaching evaluation focuses more on results and lacks objective records of the learning process, which restricts the development of personalized teaching. The maturity of artificial intelligence, especially computer vision technology, provides a new path to solve this dilemma. The purpose of this study is to integrate AI motion image intelligent analysis technology into the intelligent campus of primary schools, and build a sports teaching support system that can sense, evaluate and feedback in real-time, to explore its actual effect on improving students' classroom participation, action standardization and teaching efficiency. This study adopts a quasi-experimental research method, selects classes with similar conditions in Hedu Primary School as experimental classes and control classes, and conducts a one-semester teaching experiment. In the experimental class, high-definition intelligent cameras are deployed for

networking, and its core AI vision algorithm can perform real-time, non-contact recognition and analysis of student movement postures in video streams without the need for wearable devices. The system has a built-in action model based on national curriculum standards, which automatically compares when students practice, generates overall evaluations on rhythm, coordination, and degree of completion, and provides immediate prompts through voice or visual interface, acting as an assistant teacher role. After class, the system automatically generates class and individual learning reports; class reports help teachers locate teaching difficulties and priorities; individual reports record the changing trends of student action standards, clearly showing progress and shortcomings.

Research methods 1. Use the classroom behavior observation table to record indicators such as the number of times students take the initiative to practice; 2. Invite third-party senior teachers to conduct blind evaluations of student action videos before and after the experiment; 3. Conduct semi-structured interviews with teachers and students in the experimental class to understand their subjective feelings. Research data shows that the intervention of the AI system has had a significant positive impact: it enhances learning motivation and participation, the average effective exercise time in the experimental class has increased by about 30%, and the initiative and number of repetitions of student practice have increased significantly. In the post-test blind evaluation, the experimental class students scored significantly higher than the control class in terms of the standardization of movements in projects such as radio gymnastics and rope skipping. The system has partially liberated teachers from repetitive observation and basic correction, allowing them to focus more

on teaching organization and personalized interaction. The quantitative reports provided by the system have moved teaching evaluation from empirical judgment to data support, helping teachers develop more precise teaching plans. This study confirms that the intelligent campus system based on AI motion image analysis, through non-perceptual collection, intelligent evaluation, and immediate feedback, has successfully created a "digital intelligence" physical education teaching environment. It effectively solves the pain points of rough guidance and delayed feedback in traditional teaching, implements process evaluation, and stimulates students' intrinsic learning motivation. It not only improves the immediate effect of the classroom but also cultivates students' awareness and habits of scientific exercise. This technology is an effective path to promote personalized, precise, and scientific physical education teaching in primary schools. Future research can further explore its application adaptability and long-term effects in more sports events and different school segments.

Keywords: Physical Education; Primary Schools; AI Motion Image Analysis

Theme 4

Scientific Exercise and Health, Cultural Advancement

Modern Approaches to Rehabilitation of Athletes After Arthroscopic Plastic Surgery of the Anterior Cruciate Ligament

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Abstract. The article presents the results of the implementation of a comprehensive physical rehabilitation program for athletes who underwent arthroscopic plastic surgery of the anterior cruciate ligament at the sports rehabilitation stage. A distinctive feature of the program is the use of balance training, elements of the Mulligan concept, and performing exercises that simulate motor actions in a particular sport in an aquatic environment.

The most common injury to the anterior cruciate ligament occurs among people involved in sports. An analysis of the studies revealed that in 44% of cases, secondary rupture occurs as a result of biomechanical asymmetry and impaired afferent conduction of the limb (Hewett T.E., Di Stasi S.L., Myer G.D., 2013). Thus, even with the restoration of an athlete's motor activity and his return to sports, there remains a risk of secondary injury during near-extreme and extreme loads. All this necessitates the search for new means, methods and forms of physical rehabilitation that would contribute to the fullest possible restoration of the stability of the athlete's knee joint and sensorimotor control in motion control.

The developed comprehensive program of physical rehabilitation of athletes after surgical treatment of anterior cruciate ligament injury is a scientifically based, structured program. It integrates advanced approaches of manual therapy (Mulligan concept), neuromuscular training (balance training) and hydrokinesotherapy. This program is a specialized component of rehabilitation aimed at restoring temporarily lost or significantly reduced morphofunctional abilities of the musculoskeletal system. Her ultimate goal is not just to return to daily activity, but to fully restore athletic fitness and prevent recurrence of injuries, which is especially important in high-performance sports, where the requirements for stability and proprioception of the knee joint are extremely high.

The key principle of the developed program is strict phasing and continuity. Each stage solves specific tasks, preparing the athlete's body for the next, higher level of stress.

1. Early postoperative stage (1st week). The goal of treatment: reduction of postoperative symptoms (pain, edema), improvement of tissue trophism, activation of hip muscles to stabilize the joint, prevention of hypotrophy.
2. Late postoperative stage (2-4 weeks). Goal: to restore control over the limb, increase the amplitude of passive and active movements, and lay the foundation for proprioceptive training.
3. Functional stage (5-8 weeks). Goal: to restore strength indicators and basic proprioception, to prepare for complex coordinated movements.
4. Training and recovery stage (9-24 weeks). Goal: to fully restore the functional capabilities of the limb, achieve symmetry in strength, coordination and proprioception, and prepare for a return to athletic activity. Mulligan's concept in rehabilitation, this approach is not just a

manual technique, but a rehabilitation philosophy based on the principle of "painless movement." The essence of the method is a combination of passive mobilization performed by the therapist (for example, traction or gliding of the joint), with simultaneous active, painless movement performed by the patient himself.

Mechanism of action: it is assumed that after injury and surgery, the articular surfaces shift (positional fault), which disrupts biomechanics and causes pain. Mobilization with movement (MWM) allows you to "reset" the proprioceptive system of the joint, restoring the correct position and movement, thereby instantly eliminating pain and increasing the amplitude. As part of the technique, this was used to restore flexion/extension in the knee joint, as well as to mobilize the patella. The use of the aquatic environment is an indispensable component at the functional and training and recovery stages. Biomechanical advantages: hydrostatic pressure reduces peripheral edema and improves proprioceptive feedback; reducing the weight load on the knee joint to 1/10 of the body weight in the air allows you to start walking and squatting training much earlier than on land; warm water (28-30 °C) promotes muscle relaxation and improves the elasticity of connective tissue; water viscosity: creates natural resistance in all directions of movement, which is ideal for developing strength endurance and coordination.

Balance training and neuromuscular stimulation. This component is central to restoring proprioception, the ability of the joint and brain to "feel" their position in space, which is crucial for stability and prevention of repeated injuries. Theoretical justification (N.A. Bernstein's concept): the essence of coordination is to overcome excessive degrees of freedom of a moving system. After an anterior cruciate ligament injury, the

"sensors" (mechanoreceptors) that send information about the tension and position of the joint to the central nervous system are disrupted. Balance training forces the nervous system to relearn how to process this information and control the stabilizer muscles. Development of coordination with external resistance (Advanced level): Catching and throwing a ball while standing on one leg on a BOSU; exercises with resistance bands while standing on an unstable platform; performing exercises on suspension systems (for example, the "plank" in TRX), which require simultaneous stabilization of the body and joints.

As a result of our research, data were obtained that allowed us to track the dynamics of recovery of knee joint mobility indicators, the possibility of locomotion in the functional period, and the severity of pain syndrome.

Comparison of two rehabilitation groups Group A: Arthroscopic plastic surgery of the anterior cruciate ligament + Standard rehabilitation (n=9) Group B: Arthroscopic plastic surgery of the anterior cruciate ligament reconstruction + Developed rehabilitation program (n=9). At the beginning of the first week of rehabilitation, both groups were comparable in terms of movement volume ($p > 0,05$) and had no significant differences in the biomechanical properties of the muscles, which is important for the purity of the experiment. Recovery dynamics: Group B (the developed rehabilitation complex) demonstrates statistically significantly better flexion and extension indicators already at week 4 and after 8 weeks. Also, according to the results of myotonometry in group B, there are increased tone (F) and stability (S). Long-term result: both groups achieve full extension and almost complete flexion. However, group B still has a statistically lower flexion deficit compared to a healthy

leg, which is an important clinical indicator. At week 8, group B shows a significantly lower deficit in tone and stiffness compared to a healthy leg. The use of the developed rehabilitation program (group B) makes it possible to achieve goniometry targets significantly faster and with less residual movement volume deficit in the long term compared to the standard method.

According to the results of myotonometry, group B is more effective in preventing atrophy and normalizing the biomechanical properties of the quadriceps muscle, which directly affects joint stability, proprioception and reducing the risk of repeated injuries.

Modernization of the Educational Environment for Chinese Students at Bsupc: Integration of Bilingual Methods and Visual Aids

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Abstract The article is devoted to the adaptation of the “Biomechanics” course for Chinese students. The authors identify key challenges in mastering the material related to linguistic and cultural differences and suggest specific methodological solutions. These include the development of specialized textbooks, the use of visual aids and practice-oriented tasks. The practical implementation of these approaches is expected to enhance the quality of learning the discipline and facilitate the academic integration of Chinese students.

Keywords biomechanics, Chinese students, adaptation, methodology, higher education.

The increasing number of mixed study groups at the Belarusian State University of Physical Culture (BSUPC), comprising both Belarusian and Chinese students, serves as a clear testament to the university's internationalization. The primary challenge to the academic integration of international students remains the language barrier, as the Russian language proficiency of most students from China is at a basic level (A1–A2). This hinders lecture comprehension, active participation in

seminars, and the completion of independent assignments.

Therefore, the implementation of adapted educational materials that combine a bilingual approach and visualization is crucial for foreign students' comprehension of the academic discipline. Consequently, the primary focus for adjusting the educational environment for such groups involves the development and integration of teaching materials with bilingual support (Russian and Chinese). This approach also facilitates overcoming language barriers between students and instructors and enhances the overall quality of the educational process.

Duplicating key information in the students' native language significantly reduces cognitive load, accelerates knowledge acquisition, and increases motivation. This approach is most effective in practical and laboratory classes where the accurate understanding of instructions is critically important. A specific example of the effective implementation of this approach is our proposed specialized biomechanics laboratory manual [1]. Its key feature is the use of transparent linguistic constructions. Furthermore, theoretical concepts and terms are accompanied not only by translation into Chinese but also by Pinyin transcription, which substantially facilitates their correct reading and memorization [2].

In the proposed manual, the core modernizing element is the integration of visual aids. Visual imagery (diagrams, graphs, photographs, videos) compensates for language barriers and enhances information retention, which is particularly relevant for students from countries with logographic writing systems. Its structure is meticulously designed to ensure deep and meaningful learning, especially in a multilingual classroom environment. This format, which has proven its effectiveness,

facilitates rapid assimilation and accurate reproduction of information, thereby optimizing the educational process.

The laboratory manual for the academic discipline “Biomechanics” includes six laboratory works. The first three examine the kinematic characteristics of motion, while the remaining ones focus on dynamic characteristics. Each work consists of two parts: theoretical and practical. It presents a holistic methodological complex built on the principle of “from theory to practice”. Particular attention is paid to the practical component, which is organized on a modular principle: tasks are divided into logical blocks, each accompanied by a QR code. These codes lead to video materials in Chinese, demonstrating the correct sequence of all operations. This allows the student to independently, at their own pace, repeatedly review complex moments, ensuring accurate reproduction of the methodology and, as a result, independently master the material and practice task execution algorithms, thereby compensating for the language barrier.

The structure of a laboratory session in the adapted manual is designed as a continuous and supported learning path: from theoretical explanation, through visualized instructions, to independent practical action. The theoretical block serves as the foundational basis for the entire subsequent investigation. It not only lists key concepts but also describes the system of scientific knowledge and premises that determine the relevance of the work. Within this section, students study the purpose and objectives of the laboratory research, as well as the fundamental physical laws and biomechanical principles on which it is based. Particular attention is paid to mastering computer technologies for determining all characteristics of an athlete’s movement. For Chinese

students, the theoretical section is duplicated in their native language and supplemented with phonetic transcription (Pinyin) for all specialized terms, preventing their misinterpretation and mispronunciation. Only after confidently mastering the theoretical foundation does the student gain the motivational and cognitive readiness to proceed to practical part. This transition is a key moment in the educational process, as it is here that abstract knowledge is transformed into practical skills and abilities.

This approach ensures that students from China develop not only subject-specific competencies in biomechanics but also cultivate research skills, critical thinking, and the ability to work independently. Ultimately, this significantly enhances the effectiveness of the educational process in mixed groups.

Thus, the integration of bilingual methods and visual aids creates a modern educational environment that not only mitigates the language barrier but also enhances the overall quality of education. A promising direction for future development involves extending this experience to other disciplines, creating multimedia courses, and strengthening methodological support for instructors.

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Development of Strength Endurance with the Help of Rubber Resistance Bands

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Abstract This study substantiates the use of rubber bands to develop the strength endurance of the muscles of the trunk and upper body in women aged 18-21. The advantages of the method are variable resistance, joint safety, and the use of stabilizing muscles. The test results confirm the effectiveness of the exercise complex for the body, which provides the ability to withstand physical fatigue during muscular activity.

Under specific – endurance is defined in relation to a certain activity chosen as a subject of specialization. There are such types of specific endurance as speed, strength, coordination, etc. In this case, we are most interested in strength endurance – the ability to resist fatigue in muscle work with pronounced moments of strength stress.

To develop strength endurance, the method of unintended resistance is used – overcoming unintended resistance in one approach until complete fatigue. One of the advantages of using this method is the low risk of injury, which allows it to be used in training of any contingent. It is important to take into account that the increase in strength endurance in this method is facilitated by the use of a significant amount of physical activity, which is achieved through the maximum number of repetitions, rather than the maximum weight of weights. This is where rubber resistance bands demonstrate their unique advantages over traditional

weights [1].

Advantages of rubber resistance bands for the development of strength endurance:

1. Variable resistance is a key feature of resistance bands, which distinguishes them from free weights. While a barbell or dumbbell provides a constant load along the entire trajectory, the resistance of the expander increases as it stretches. This means that the muscles receive adequate load in both the initial and final phases of movement, where they are naturally stronger. This type of exercise is ideal for developing endurance, as it forces the muscles to adapt to constantly changing resistance.
2. Complex effects on the body – resistance band workouts require significant body stabilization during exercise. This activates not only large muscle groups, but also small stabilizer muscles, which often remain unused when working on simulators. This comprehensive approach develops intermuscular coordination and improves neuromuscular connections, which directly affects endurance.
3. Safety and low impact load – resistance band exercises are characterized by minimal stress on the joints and spine compared to free weights. This allows you to perform large amounts of work without the risk of injury, which is especially important for endurance training that requires multiple repetitions.
4. Versatility and accessibility – with one set of resistance bands, you can perform countless exercises for all muscle groups. Their compactness and lightness allow you to train anywhere: at home, in the office, outdoors or while traveling, ensuring the consistency of the training process necessary for the development of endurance.

5. The aesthetic indicator is an important point for attracting women to classes. Many girls do not want to "pump up", and working with a rubber resistance band offers a way to exactly the figure that is most often associated with femininity and aesthetics: taut, harmonious and embossed [2].

There are different types of resistance bands:

- Loop (ring) – closed rings made of elastic material. Their advantages are: compactness, versatility, ideal for training legs and buttocks with a multi-repetitive mode.
- Ribbon (flat) – long flat strips of latex. Multifunctional, suitable for rehabilitation, flexibility exercises and strength endurance exercises.
- Tubular with handles – rubber bands in the shape of tubes with handles at the ends. They also have advantages: comfortable grip, the ability to simulate exercises with free weights, and resistance adjustment.
- Resistance bands-harnesses – long bands without handles. Their "advantages" are: uniform tension along the entire length, maximum freedom of movement, the ability to use with a barbell to add variable resistance [3].

Thus, you can choose the right type of expander to solve any problem. In my set of exercises, I used a 200*15 cm band expander, with a manufacturer's stated load of up to 15 kg.

Examples of exercises included in the complex: 1. The starting position is a closed rack, with the tape at the bottom in a slight tension. With pulsating movements to the sides, gently lift the tape up.2. The starting position is a closed rack, with the tape at the top in a slight tension. Stretching the tape to the sides, try to lower it to the level of the upper edges of the shoulder blades.3. The starting position is a closed rack, with

the tape at the bottom in a slight tension. Smooth stretching of the tape to the sides.4. The starting position is a closed rack, with the tape in front of you in a slight tension. Smooth stretching of the tape to the sides.

At the moment, the study is ongoing, but already at the moment it is possible to note an improvement in the strength endurance of the muscles of the upper extremity girdle, abdominal and back muscles. It is also possible to note the involvement of girls in classes, as the attendance of classes remains about 95% throughout the month.

Conclusions The method of developing strength endurance in female students aged 18-21 using rubber resistance bands for the prevention of posture disorders is substantiated. Key advantages have been identified: variable resistance, joint safety, and a complex effect on stabilizer muscles. The testing of the set of exercises confirmed the effectiveness of the method and the high involvement of those involved (95 % attendance).

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Facilities of Coordination Abilities of Hockey Players Aged 9-10 With Elements from Complex Coordination Sports

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Abstract The article deals with the influence facilities of coordination abilities of hockey players aged 9-10 year with complex coordination sports' elements. There were 22 athletes divided into control (CG) and experimental (EG) groups. During 3 months, elements from acrobatics, gymnastics and figure skating were included in the training process of the experimental group.

Keywords ice hockey, coordination abilities, complex-coordination sports, children of 9-10 years old, training process.

Introduction Modern hockey requires athletes to be highly coordinated, especially at a younger age, when the basics of technique and tactics are being laid [2]. However, traditional training methods do not always provide a sufficient level of development of all coordination qualities. In this regard, there is a need to search for new effective methods, including the integration of exercises from other sports [4].

Research objective To evaluate the effectiveness of using sets from complex coordination sports (acrobatics, gymnastics, figure skating) in the training for increasing the coordination abilities of hockey players aged 9-10.

Materials and methods The study involved 22 young hockey players studying at the same sports school. They were divided into two

groups of 11 people. Over the course of 12 weeks, hockey players used our developed sets of exercises from figure skating, acrobatics, and trampoline. We used these complexes cyclically for weeks, respectively. We used complex 1 on Tuesday and Thursday of the first week, complex 2 on the second week, complex 3 on the third week, and complex 4 on the fourth week. With the onset of week 5, the cycle started all over again. All exercises were designed to address as many components of coordination as possible, such as balance, orientation in space, and the ability to rearrange and connect movements [3].

Results At the beginning of the study, the differences between the groups were insignificant ($p > 0.05$). After 12 weeks, the experimental group showed improvements in all tests. The most significant changes were noted in the balance and rhythm exercises.

Testing conducted before the experiment suggests that the study groups are identical in their initial level of physical fitness, especially in terms of coordination abilities. Thus, a pedagogical experiment can be carried out.

In comparison with the control group, the hockey players of the experimental group showed significant advantages in the results of test exercises after the experiment. For example, holding the "Stork" pose in the Romberg test in the experimental group for 0.34 seconds longer; performing the Yarotsky test for 0.73 seconds longer; deviation from the specified vector in the Minkovsky test for 4.2 cm less; test Biryuk for 0.55 seconds longer; hold dynamic balance for 0.15 seconds longer

After analyzing the indicators of children's coordination abilities based on the results of the experiment, indicate significant differences in most test exercises between the groups after the end of the experiment.

Statistical differences were not noticeable only in two test exercises: the 30-meter face run and the 30-meter back run, which indicates that the speed skills of young athletes in both groups developed at a comparable pace. However, significant differences in performance in both variants of slalom running and, accordingly, differences between the indicators in slalom and 30-meter running indicate a more pronounced development of coordination abilities of hockey players in the experimental group.

Discussion The results obtained confirm the hypothesis that the use of elements from complex coordination sports has a positive effect on the development of coordination qualities in young hockey players. The inclusion of such exercises promotes comprehensive development, improves neuromuscular regulation and adaptation to non-standard conditions, which is crucial in hockey.

Conclusions 1. A program that includes elements from other sports is effective for developing the coordination of 9-10-year-old hockey players. 2. The greatest effect is observed in exercises for balance and rhythm of movements. 3. The methodology can be recommended for use in sports schools as part of general physical training.

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Use of Technical Control in Modern Tennis

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Abstract In the modern world, tennis can be considered an international sport. This is confirmed by the number of national and international sports federations. In many countries of Europe, Asia, Australia, North and South America there is a large number of sports clubs and schools where tennis players of different levels are trained. An important criterion for an athlete's qualification is technical preparation. Another important point in this matter is the possibility of an objective assessment of the quality of the performed technical action, which is impossible without special technical means.

Introduction Technical training is directly related to the rules and conditions of competitions in sports. The direct predecessor of modern tennis is considered to be an indoor game, currently known as real tennis, court tennis or 'jeu de paume' (literally translated palm game). 'Jeu de paume', which could be played simultaneously by up to 12 people, appeared in the 11th century in France, according to many researchers, most likely in monasteries. They played, mainly in monastery premises, on a stone floor, and not only young ministers of the church, but also clergy of the highest rank, up to bishops and cardinals. At first, in this game the ball was hit by hand, then gloves, bats and, only in the 16th century, rackets and a net appeared. By the end of the 16th century, there

were more than 250 specially equipped courts in Paris and more than 7 thousand fans of this game. Tennis spread to Italy, Switzerland, Sweden, Austria-Hungary and other countries of the Old World [4].

Studying the history of tennis is primarily necessary to understand the most important trends in its development, the ability to correctly predict further transformations and plan successful training, including technical, for tennis athletes. Such changes can be clearly seen in the role of serve in tennis matches. For quite a long time, putting the ball into play, what we now call serving, was not considered an element of the game; it was impossible to win a point directly from serving. Therefore, serving was most often entrusted to servants. In French, a servant was called servant, and his introduction of the ball into the game was called ‘serviz’ (service). It is known that the English king Henry VIII (1509–1547) had special servants for these purposes [4]. Centuries have passed since then, tennis and its rules have changed, but even now at all international meetings the serve is called ‘servize’. Now the serve in tennis is considered one of the main elements of the game. An ace, a serve executed in such a way that the receiver does not have time to touch the ball with his racket, is especially valued. The modern serve is a variable component of the game and requires high technical training from the player. At the same time, in the early stages of preparation, the force of the serve (the speed of the ball) is assessed visually, which does not allow the objective use of quantitative methods for processing and analyzing information.

The purpose of the work is to determine objective ways of assessing and analyzing the technical preparedness of a tennis player using modern technical means.

Research methodology: 1. Historiographic method (comparative

analysis of scientific literature); 2. Analytical method; 3. Prognostic method.

Hypothesis Modern technologies, equipment and equipment place increasingly high demands on the technical training of tennis athletes. This trend, according to the authors, will continue for decades to come. It will be driven by the use of new synthetic fibers and composite materials to create new rackets and balls [3]. The study of the characteristics of the human body will continue to develop individual training programs and individual techniques, analyzing the movements of tennis players using computer biomechanical programs to improve hitting technique and reduce the risk of injury. Personalization technologies will allow you to create uniforms that take into account the individual parameters and preferences of each athlete. The use of special electronic technologies to analyze the athlete's technical preparedness and the overall pattern of the game based on the collected data can lead to revolutionary changes in the training process. But the use of special technical means, according to the authors, is necessary not only at the stage of highest sports mastery, but also at the early stages of training.

Organization of the study To conduct a pilot study, a group of 20 students (boys) was recruited from the BSUPC. Age 18-19 years, sports qualification CCM – 1st category. They were asked to perform the following technical actions: serve, backhand, forehand which are the main technical actions. Each action was given 10 attempts. To record the result, the following technical means were used: Koospur Tennis POD (a sensor for measuring the speed of the ball, mounted on the racket handle), Court Royal (Personal Sports Radar), a stationary device installed directly on the tennis court.

Research results As a result of the study, the following results were obtained:

1. Large differences in feed rates have been found. Maximum 157 km/h., minimum 102 km/h.; 2. The speed of the forehand is also a big difference. Maximum 158 km/h., minimum 72 km/h.; 3. Backhand, also differences of more than 40 km/h: maximum 147 km/h, minimum 101 km/h.

Conclusions The data obtained as a result of the pilot study allow us to draw the following conclusions. Despite the same sports qualifications, the study participants demonstrate different results with significant differences. Moreover, in the personal ten attempts given to each participant, differences were also established, indicating a lack of stability. This gives grounds to the authors to assert that, agreeing with all experts in the field of tennis [1], [2], about the need for general and individual technical training at the initial stage, it is also important to have a means of objectively assessing the level of technical readiness of a tennis athlete and, if necessary, correcting and adjusting the technical actions performed.

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Application of Specialized Training Tools for Young Cross-Country Skiers in the Preparatory Period

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Abstract The article examines the application of specialized training tools for young cross-country skiers during the preparatory period. The methods for developing key physical qualities – such as aerobic endurance, strength, and coordination – are analyzed. Particular attention is given to the rational balance of training volume and intensity. Practical recommendations are proposed to optimize the training process and improve competitive performance. The findings of the study may be applied in the preparation of young cross-country skiers.

Relevance of the Study At the present stage of development of elite sports, the training of athletes is impossible without high-quality scientific and methodological support of various aspects of the training process. The modern format of cross-country skiing, which includes individual and team sprints, mass starts, and other disciplines, imposes demands on athletes related to high-intensity performance. This requires the maximum realization of functional potential through technical proficiency and tactical skills [1].

Participation in competitions is used as an effective means of stimulating the adaptive responses of an athlete's body. Competitions constitute an active component of athletes' specialized preparation – physical, technical, psychological, and tactical – integrating all types of

training into a unified system aimed at achieving high sports performance. Only under competitive conditions can athletes reach the level of maximum functional strain and perform workloads that are unattainable during training sessions [2].

When designing the training process and selecting specialized training means, it is necessary to take into account all the key parameters of competitive activity and to model them within the training process [3]. The choice of specialized training means and the modeling of the training process should be based on the general principles and parameters of cross-country skiing: movement cycles, exercise structure, heart rate (HR) during workload, speed of movement, stride length and frequency, as well as other factors [4, 5].

Research Aim to enhance the level of specialized physical training of young cross-country skiers aged 14–16 during the preparatory period.

Research Objectives 1. To systematize theoretical and methodological data on the development of specialized physical training of young cross-country skiers during the preparatory period. 2. To determine the optimal combination of specialized training means for young cross-country skiers aged 14–16 during the preparatory period.

Materials and Methods To address the stated objectives, the following methods were employed: theoretical analysis and synthesis of scientific and methodological literature, questionnaires, examination of specialized documentary materials, pedagogical observation, and methods of mathematical and statistical processing of research results.

Research Results The analysis of specialized literature on cross-country skiing revealed that most studies focus on the balance between training volume and intensity, the combination of training means

and methods, the optimal development of athletes' key physical qualities, as well as the individualization of training loads. However, no well-founded recommendations were identified regarding immediate preparation for competitions during the snowless period, particularly with the selection of specialized training means for young cross-country skiers aged 14–16.

The conducted survey was aimed at identifying the training means used in cross-country skiing during the preparatory period of the annual macrocycle. It was established that during the snow-covered period, the primary training means (98%) is skiing. In the snowless period, young cross-country skiers distribute their training time as follows: 47% – roller skiing using various techniques, 28% – running with ski imitation movements, 10% – specialized jumping exercises, 7% – specific strength exercises on training machines, 4% – cross-country running, 3% – general strength exercises, and 1% – other exercises.

The study showed that during the preparatory period, young cross-country skiers employ the following training means: general preparatory exercises (cross-country running, general strength exercises) account for 8% of the total training time, while special preparatory exercises (running with ski imitation movements, roller skiing, specific strength exercises on training machines, specialized jumping exercises) comprise 92%. For high-quality preparation of young cross-country skiers, it is recommended to conduct training sessions on the courses where the winter competitions will be held.

Course modeling during training makes it possible to manage the training process and achieve better preparation for competitions in terms of functional, technical, and psychological readiness [6].

In preparation for the winter competition season, the majority of skiers (78%) plan to achieve high sports results in races using both classical and skating techniques. However, the weather conditions under which training takes place play a significant role in the choice of training means and skiing technique: 93% of coaches take this factor into account.

Under the conditions of a training camp, where the schedule allows for two or three training sessions per day, a balanced combination of training volume and intensity, as well as training means and skiing techniques, is of critical importance. The survey of coaches and athletes revealed the main approaches to combining two daily training sessions during the snowless period: 1. First session – running with classical skiing imitation movements; second session – roller skiing using the skating technique (27%).

2. First session – cross-country running and specialized jumping exercises for the skating technique; second session – roller skiing using the classical technique (25%). 3. First session – roller skiing using the classical (or skating) technique; second session – cross-country running and specialized strength exercises on training machines (19%). 4. First session – running with classical skiing imitation movements; second session – roller skiing using the classical technique (17%). 5. First session – roller skiing using the classical (or skating) technique; second session – running with classical skiing imitation movements (12%).

Combination of two daily training sessions during the snow-covered period 1. First session – classical technique; second session – skating technique (35%). 2. First session – skating technique; second session – classical technique (35%). 3. Both sessions – using either the classical or the skating technique (30%).

Conclusions 1. Based on the analysis of athletes' individual training plans, self-monitoring diaries, and pedagogical observations, it was found that coaches rarely rely on scientific justification when choosing training means and skiing techniques depending on which session is considered the main one on a given day. In our opinion, this factor should be given primary consideration, as it contributes to the development of both functional performance indicators and athletes' competitive skills and technical mastery. 2. Pedagogical studies have shown that during the preparatory period, young cross-country skiers employ a wide range of approaches to the use of general and specialized training means, skiing techniques, and other aspects. At the same time, many coaches consider it necessary to conduct targeted preparation for major competitions specifically for participation in either classical or skating races. 3. During the immediate pre-competition preparation on snow, both athletes and coaches (100%) regard skiing with various techniques as the primary training means, while all other means are considered auxiliary. In the snowless period, the main training means are roller skiing (47%) and running with ski imitation movements (28%).

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Analysis of Sport Climbing Development in Omsk Region

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Abstract This article is about sport climbing development in Omsk region. The authors analyzed Omsk climbing facilities, regional climbing federation, amateur and sportsmen contingent.

The physical education and sports are important field in Russian Federation. The strategy for the development of this field for the period up to 2030 was developed in accordance with the instructions of the President of the Russian Federation. It was created for systematically developing physical education and sports in Russia and to involve more people in this field.

The aim of strategy is to establish main directions and promote conditions that provide equal opportunities for citizens to lead a healthy lifestyle, engage in physical culture and sports on a regular basis, and enhance the competitiveness of Russian sports [3].

Sport climbing is a kind of sports that continues to develop till now. It is gaining popularity among the Russian population because of the unique feature. Climbing is not only a sport with its athletic achievements but also promotes intellectual and spiritual development. Climbers overcome a fear of height, it combines mental, emotional and physical activity. Now sport climbing is included in school curricula and social programs for the rehabilitation of individuals with disabilities in many countries [2].

The landform of Omsk region is plain with no mountains and hills. That is why sport climbing started to develop indoor. Its origins date back to 2001 when the first climbing wall in Omsk with negative tilt angles was built. It is till now located in Palace of health (park Green Island). It was rebuilt and modified in 2005, 2007 and 2014.

The new stage of sport climbing development in Omsk region was in 2005 when sports school №35 started to promote this kind of sport. The new climbing wall on the basis of this school was built in 2012. Then sport climbing started to extend into villages of Omsk region: the new climbing wall in Azovo was built in 2006, also new climbing walls were built on the basis of secondary schools in the villages of Moskalenki and Sidelnikovo in 2013.

The opening of Omsk Regional Climbing Federation in 2009 was the significant event that influenced further development of sport climbing in Omsk. Then, in 2014, the federation was accredited and became a member of the Russian Climbing Federation.

The Omsk regional climbing federation participates in grant programs successfully including receiving a grant from the President of the Russian Federation in 2018, which was used to purchase two mobile climbing walls: a bouldering wall and a speed climbing wall with large holds, which are part of the standard route. Now mobile bouldering wall is used for children's trainings. But the speed wall is utilized for mass sports event such as "Shtormfest" [1].

In 2018, the first commercial climbing wall in Omsk was opened. During its existence (until 2022), it attracted a significant number of people to climbing. However, there are currently no commercial climbing walls in Omsk.

The 2022 was a new milestone in Omsk climbing - a new climbing center was opened. It was built in a short timeframe thanks to the Russian Olympic Committee's support fund. The modern climbing center includes modules for all disciplines, including a 13.5-meter-high lead climbing sector, a bouldering module with various planes, and a 15-meter-high standard speed route with a timing system. In total, there are over 1,000 square meters of climbing areas [4].

Climbing in Omsk is directed to both professional climbers and amateurs. About 80 people study at the sports school. There are 2 Masters of Sports of Russia in Omsk, athletes become winners of rating competitions and join the Russian national team. However, not only professionals but also amateurs, students, schoolchildren, and children of preschool age can practice climbing.

Now we want to characterize the contingent of climbers in Omsk. The main group of climbers is between the ages of 7 and 45. According to the Fitbase program (which handles all transactions and stores customer data), the largest age group is under 12 years old. The second largest group is between 26 and 35 years old, and the third largest group is between 36 and 45 years old. However, anyone can climb without any upper age limit. According to the data in the chart, about 50 people aged 55 and older visited the climbing center in the two years it has been operating.

Currently, there are 3 climbing walls in Omsk, where people can learn about climbing, spend their leisure time, and practice. 1. The Omsk Climbing School is located at Starozagorodnaya Roshcha Street, 10. This climbing wall is the oldest in Omsk. It is used for group and individual trainings, as well as for excursions and birthday parties. The climbing wall has a good physical exercises area. Trainings are open to people

aged 5 and above. 2. The Centre of climbing is located at 1-ya Zheleznodorozhnaya Street, 1 k. 3. This is the most modern climbing center in Omsk that has modern certified equipment, holds and volumes. The climbing wall offers introductory, group, and individual training, independent climbing, excursions, and birthday parties. The climbing center has a large number of trendy climbing routes (both difficult and bouldering), as well as an area for physical exercises and special physical training. Trainings are open to people aged 7 and above. 3. The “Energy” climbing wall is located at Chelyuskintsev Street, 98/1. It is a base of the Sports School No. 35. Only sports school students can train here, the climbing center does not offer classes for commercial groups. The sports school's groups are recruited in the summer, and students are selected based on their performance in the tests.

All climbing walls in Omsk are located on the right bank of the Irtysh River. Price analysis showed that the prices for 1 lesson vary from 400 RUB to 1500 RUB. There are also monthly subscriptions for the number of lessons with a coach, as well as unlimited for independent visits. It should be noted that climbing walls also provide additional services: equipment rental, sale of climbing goods, etc.

Nevertheless, many people in Omsk region do not know about such sports and physical activity as sport climbing. Even though sport climbing is an Olympic sport and has already been represented at two Olympic Games. Therefore, there is a clear need to introduce people to this sport and popularize it.

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Methodology for Integrating Anti-Doping Education into the Training Process of Sports Schools

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Abstract The article addresses the pressing issue of integrating anti-doping education into the training and educational processes of sports schools. It argues for the necessity of transitioning from one-time lectures to continuous and systematic education. A practical methodology is proposed, which includes a phased implementation, varied forms of engagement, and effectiveness criteria. Special attention is given to the role of the coach as a key agent in anti-doping policy. The methodology aims to foster a strong value-based stance among young athletes.

Introduction The issue of doping in modern sports is increasingly shifting to younger age groups, highlighting the need to begin systematic anti-doping efforts at the early training stage in sports schools. Traditional approaches, which often consist of one-time lectures or handing out leaflets, have proven to be ineffective [1]. The aim of this article is to develop and propose a method for seamlessly integrating anti-doping education into the daily training and educational activities of sports schools.

An effective integration method should be continuous, multi-layered, and tailored to the psychological characteristics of the students' age group. Its implementation involves three primary stages.

1. Preparatory Stage. A key role in this stage is assigned to the

coaching and teaching staff. It is essential to organize a series of workshops and training sessions for coaches, involving experts from anti-doping organizations [4]. The goal is not only to impart knowledge but also to instill a sense of personal responsibility among coaches for nurturing “clean” athletes [2]. Concurrently, an audit of existing training programs will be conducted, and a unified thematic plan will be developed to integrate anti-doping topics into the theoretical sections of training for various sports.

2. Practical Implementation Stage. Integration of education occurs through several channels: - In the Training Process: Discussion of ethical dilemmas and the consequences of doping is incorporated directly into training sessions. For example, while working on developing physical attributes, a coach can explain which substances artificially enhance these traits and the irreversible health consequences that may follow. - In Theoretical Classes: Interactive formats are employed, such as analyzing real-life sports case studies, role-playing games like "The Doping Trial," and team debates on "The Cost of Victory" [3]. This approach fosters critical thinking and helps students form their own well-reasoned positions. - In Educational Activities: Organizing meetings with well-known “clean” athletes, conducting thematic poster or essay competitions, and holding joint viewings and discussions of documentaries on doping scandals.

3. Control and Effectiveness Evaluation Stage. The effectiveness of the methodology should not be assessed by formal criteria (e.g., number of lectures conducted). Key criteria include: - Knowledge Dynamics: Regular anonymous testing on the knowledge of the WADA Prohibited List, rights, and responsibilities of athletes. - Formation of Attitudes: Surveys and the method of unfinished sentences to evaluate changes in attitudes towards

doping. - Behavioral Intentions: Analysis of decisions made by athletes in simulated moral choice scenarios [3].

Conclusion The proposed methodology overcomes the formalistic approach to anti-doping education, transforming it from a burden into an integral element of sports training. Its core is represented by the coach-educator, who, through personal example and ongoing dialogue, conveys the values of fair competition and health preservation. Systematic integration of education into the training process of sports schools is a long-term investment in the development of a fundamentally new generation of athletes for whom the rejection of doping will become a conscious and the only acceptable norm of behavior.

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On the Relevance of Research Aimed at Improving the Effectiveness of Technical and Tactical Training for Belarusian and Chinese Basketball Players Aged 16–18

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Abstract The article presents the results of an analysis of the specifics of technical and tactical training of basketball players aged 16–18 in China and the Republic of Belarus, which determine the relevance of conducting a specialized scientific study aimed at improving its effectiveness. Common directions have been identified to increase the effectiveness of technical and tactical training of sports reserves in Chinese and Belarusian basketball.

Keywords basketball, structure of sports training, training of sports reserve.

Introduction In the context of the rapid development of sports and growing competition, the issue of improving the quality of sports reserve training is of particular importance. Practice shows that the sports training of basketball players aged 16–18 has features determined not only by their level of preparedness and individual development indicators, but also by the objective requirements faced by a young athlete when transitioning from youth basketball to the stage of higher sports mastery.

The purpose of this work was to substantiate the relevance of

research aimed at improving the effectiveness of technical and tactical training of Belarusian and Chinese basketball players aged 16–18.

The study was conducted using methods of analysis of regulatory documents and specialized literature.

Specifics of sports training of basketball players aged 16–18 in China According to Chinese researchers, the age of 16–18 marks a critical period of transition from the stage of sports improvement through selection for participation in high-level competitions, which marks the beginning of their professional growth and development. This stage is extremely important for athletes in determining their competitiveness and career development path [1]. The methodology of training and a scientifically grounded selection system, including various types of testing, are of decisive importance for the development of a sports reserve from identified talents. According to the “Manual for Testing and Evaluating the Technical and Physical Training of Basketball Players of the Chinese Basketball Association” [2] and other regulatory documents, a step-by-step system of training and testing has been developed. It includes testing to determine the level of technical preparedness, evaluation through simulation of real game actions, and a comprehensive study of the abilities of young basketball players, providing a theoretical and practical basis for optimizing the development of a sports reserve from talented young players.

Physical preparation is the foundation of a basketball player’s competitiveness. Selection in this age group is based on the testing model “general physical fitness + assessment of specific physical qualities.” The test for determining the level of general physical readiness is based on the “Manual for Testing and Evaluating the Technical and Physical Training

of Basketball Players of the Chinese Basketball Association” [2]. For example, only if the standards are met for indicators such as sprinting speed, vertical jump, ball contact height, and special speed endurance, can the player be selected for the next stage.

Standard testing of technical readiness is carried out according to the methodology presented in the “Manual for Testing and Evaluating the Technical and Physical Training of Basketball Players of the Chinese Basketball Association” [2]. At the age of 16, the main focus is on standardizing the requirements for performing basic technical elements, such as the speed of a two-hand chest pass (boys ≥ 12 m/s, girls ≥ 10 m/s), dribbling rhythm stability, and directional movement changes, etc. At ages 17–18, the complexity of technical combinations increases: the quality and speed of performing combined moves are evaluated, such as “dribbling acceleration–quick stop–jump shot” and “screen–pass–catch–shot.” Based on the results of regular testing, targeted improvements in the quality of technical training are implemented.

The frequency of testing is determined by the model “monthly special testing + quarterly comprehensive testing.” Monthly testing focuses on one or two key skills – for example, shooting accuracy in March and defensive footwork in April – while quarterly testing covers all technical elements, reflecting the dynamics of skill development. The test results use a dual feedback mechanism: “standard rating + problem diagnostics.” For athletes not meeting standards, the coaching staff develops individualized corrective training plans.

Therefore, the main goal of training young basketball players aged 16–18 is to achieve the key transition from “basic skills” to “practical application,” laying a solid foundation for becoming professional or

high-level university players in the future.

Specifics of sports training of basketball players aged 16–18 in the Republic of Belarus The structure of sports training for basketball players in the Republic of Belarus is a multi-year process characterized by consistent continuity and age-appropriate training means used at each stage [3]. The structure and content of the sports training process are determined by the Basketball Training Program [4], developed in accordance with regulatory requirements and taking into account theoretical and methodological principles and physiological patterns of young athlete development.

By the age of 16, athletes reach the stage of sports improvement, having undergone a multi-level system of pedagogical control and selection.

Starting from the initial training stage (IT), at the end of each academic year, athletes are required to undergo testing of physical and technical preparedness using control-transfer tests to determine the level and dynamics of relevant indicators.

At subsequent stages of sports training, the curriculum provides for an expansion of the structure of control over special physical and technical readiness: the control exercises used at previous stages are supplemented with more complex ones. Beginning with the first year of training in studying and training groups (STG), tests assessing the accuracy of passing and shooting from medium and long distances are additionally applied to evaluate technical preparedness.

At the stage of sports improvement (SI), pedagogical control becomes more complex compared to previous stages (IT, STG). To assess athletes' strength capabilities, two tests are used: "bench press" and

“push-ups,” while the level of speed endurance is determined using the “Yo-Yo test.” Technical readiness is additionally assessed by jump shot accuracy and performance in a modified Rehako test. Comprehensive assessment of readiness is conducted according to the criteria outlined in the program [4].

From the STG stage onward, to assess the quality of performing technical and tactical actions (according to the stage of sports training), in addition to tests with objective indicators (time, number of hits, etc.), a visual expert evaluation is recommended.

Thus, the sports training of basketball players aged 16–18 is aimed at solving the main task of the SI stage: preparing a sports reserve for club and national basketball teams. This age is a transitional period to the 4th stage of long-term sports training – the stage of higher sports mastery (HSM). Young athletes, starting from age 17, depending on when they began basketball and the duration of training at previous stages, move to youth or adult basketball: they are included in basketball clubs and national teams of the republic.

Conclusion Basketball players in both China and the Republic of Belarus aged 16–18 are in the process of transitioning from youth to adult basketball. This transition does not always result in the continuation of a sports career, as not all players can adapt to the higher demands of the new stage of sports mastery. This study identified the specifics of sports training of Belarusian and Chinese basketball players aged 16–18 and highlighted the relevance of creating conditions for a “smooth” transition from youth to adult basketball, improving players’ skills, and continuing their careers at a higher level.

In practice, this determines the need to develop new methods of

technical and tactical training for basketball players aged 16–18, aimed at improving players' adaptation efficiency to higher objective requirements.

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The Three-Level Physical Education System in Russia

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Abstract This article analyzes the system of continuous physical education, structured on a three-tier principle: preschool, school, and university levels. The work outlines the goals, content, and expected outcomes of each of the three stages. It is concluded that this principle in the field of physical culture creates a solid foundation for strengthening the health and comprehensive development of a person.

Physical education is a purposeful process of developing and improving a person's physical qualities, such as strength, endurance, speed, flexibility, and agility, to achieve harmonious physical development and increase work capacity. It can be general, aimed at comprehensive development, or specialized, focused on a specific sport or professional activity. The formation of a healthy, physically developed individual is a long, sequential process that requires clear coordination between all levels of education. This approach is based on the concept of continuous physical education, built on a three-tier principle: preschool, school, and university. The purpose of the article is to reveal the goals, content, and expected outcomes of each stage, demonstrating how their integration creates a solid foundation for the harmonious development of the individual.

Physical education began to be taught in kindergartens, alongside other activities, in the 1950s. Its introduction is driven by the physiological and mental characteristics of a child's organism, as it was proven that the younger the child, the stronger the therapeutic and preventive impact on their body, which could also positively influence their mental state and strengthen the nervous system. Preschool age is considered the most favorable for introduction to physical activities, as this is when the foundations of physical, mental, and intellectual development are formed, along with general health. Due to a weak immune system, many children under the age of 7 often face various seasonal colds and viruses. As is known, regular physical education helps boost immunity and contributes to a child's harmonious development; therefore, this discipline should be present at all stages of a person's development and education. Furthermore, the integration of physical training into the educational program can be justified physiologically, as children have a lot of energy that needs to be released, and the most rational way to do this is through physical education classes [1]. Attending physical education classes in kindergarten under the guidance of an instructor allows children to perform simple exercises and participate in relay races conducted in a playful form, often with musical accompaniment to engage them. Thus, in these classes, children learn long and high jumps, how to squat, different types of walking and running, and learn to overcome various challenges: jumping onto a "step," jumping over various barriers, and crawling under bars. Classes are held 3 times a week for 15-30 minutes, depending on the age of the group [2].

The next stage of physical training for children is school. Physical education in school is important for a student's physical development,

namely for strengthening health, developing coordination and endurance, social and personal growth, and fostering discipline, leadership skills, and stress resistance. At the lessons schoolchildren begin to learn the basics of various exercises and are taught games such as volleyball and football. During winter, they learn to ski or skate on ice. If the school has a swimming pool, lessons are held there, allowing children to learn how to swim. Furthermore, a theoretical component is introduced in the lessons, which includes explaining exercise techniques and familiarizing students with the basic terminology related to the lesson's topic.

In middle and high school, physical education classes introduce "checkpoints" – standardized tests that allow for tracking progress in mastering exercises. Each year, students delve deeper into the discipline. Lessons last 40 minutes, during which teenagers learn new games and hone their skills in familiar activities, participating in competitions and relay races. Through these activities, students improve their health and boost their immunity, develop social skills and the ability to work in a team, form healthy habits, and in the process, learn to cope with stress and improve their physical abilities [3].

The final stage is studied in universities. The classes have a clear structure and educational goals. University physical education differs from school physical education. Students are offered a choice of sports specializations that align with their interests and physical capabilities. The main objectives of this discipline are health promotion (as in kindergartens and schools), increased work capacity, and the prevention of diseases caused by a sedentary lifestyle and neuro-psychic stress. It also develops fortitude and teaches students to cope with physical and emotional stresses in their future professional careers. Most of the universities in Russia offer

sports such as volleyball, basketball, football, and others in their physical education programs, which develop team spirit, coordination, and endurance. However, some universities use fitness training programs, for example, aerobics, yoga, and gymnastics. These forms of exercise help maintain muscle tone, improve posture, and enhance overall well-being. A typical university physical education class lasts 90 minutes. It starts with an organizational moment and attendance check (5-7 minutes), followed by a warm-up to prepare the body for exertion (15-20 minutes). The main part, with exercises specific to the chosen section, takes 50-60 minutes, and the class concludes with a summary. Standard tests usually include running various distances, strength exercises, and flexibility exercises. Depending on the chosen sport, the class may vary. Furthermore, for students with health limitations, there are special medical groups (SMG) and physical therapy groups (PT), which include sets of exercises adapted for specific health conditions.

The conducted analysis allows us to state that the three-tier system of physical education is a holistic and sequential process aimed at forming a harmoniously developed individual. The effectiveness of the entire system directly depends on the continuity between its levels. At the preschool stage, an interest in motor activity is formed through play, developing basic physical qualities. In school, teachers transform playful activity into conscious skills and abilities. Finally, the university completes the formation of an individual's physical culture, adapting it to adult life and fostering a conscious habit of regular exercise [4].

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Review of Student-Age Opinions on Holding Military and Patriotic Events

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Abstract The article analyzed the opinions of student youth on military-patriotic events. The review reported key factors, influencing students' interest; the most relevant forms of the events in cultivating patriotism. The findings have the potential to improve the quality of patriotic educational work in higher educational institutions.

The cultivation of patriotism among the younger generation and their preparation for defending the homeland have consistently remained fundamental priorities of Russian state policy. Considerable emphasis is placed on patriotic upbringing, as it is regarded as an essential prerequisite for safeguarding the national security of the Russian Federation [1].

Military and patriotic education is a complex, well-structured, and purposeful process carried out through the joint efforts of governmental institutions, social organizations, and public associations. Its objectives are to nurture a strong sense of patriotic awareness among young people, instill loyalty to the nation, and develop their readiness to fulfill civic responsibilities [3].

Due to the complex political situation in the world community, the question of the readiness of modern youth to serve in the Armed Forces of the Russian Federation is acute. The limitation of the service life of one year significantly increased the requirements for the quality of training of young people of pre-conscription age, for military service.

In the current educational context, patriotic principles should serve as a central foundation for shaping socially significant values and convictions among young people, while also fostering their willingness and capacity to contribute actively to the well-being of the nation.

To explore students' views on military-patriotic events, a survey was carried out at the Siberian State University of Physical Education and Sports, involving 368 participants. The sample included 80% undergraduate and 20% graduate students, with 45% representing the Faculty of Physical Education, 23% - the Faculty of Sports, 20% - the Scientific and Pedagogical Faculty, and 12% - the Faculty of Distance Education. Overall, the respondents consisted of 41% men and 59% women, ranging in age from 18 to 42.

According to the survey, for the majority of respondents, patriotism is love for their family and loved ones (32%). Also popular answers were "devotion, attachment to the Motherland" (27%), "love for your peoples" (23%) and "readiness for any sacrifices for the sake of the Motherland" (16%). This shows that students mainly understand patriotism as a manifestation of love and devotion to the Motherland, pride in their country, as well as a willingness to defend its interests.

Parents and relatives (34%), friends and people around (40%), peers and teachers (23%) play a key role in fostering patriotic feelings. These findings prove that patriotism is a set of many factors.

Nowadays students have the high level of patriotism and about 70% of respondents feel proud of the country.

The majority of respondents (67%) consider patriotic events to be an integral part of educational work in higher educational institutions. This result underlines the necessity of carrying out military-patriotic programs in universities.

The most important forms of military-patriotic events, according to the respondents, are: military tactical exercises and training (for example, an obstacle course), lectures, seminars and master classes on military history and tactics, volunteer actions to improve memorial sites or help veterans and meetings with veterans and war heroes (83, 72, 57 and 40%, respectively). Respondents consider the least important forms of military-patriotic events to be: participation in parades, demonstrations and patriotic processions (34%), excursions to military facilities, museums or memorials (31%) and contests, quizzes, intellectual games on military subjects (18%).

This suggests that students tend to favor practical and emotionally engaging forms of patriotic education, which are capable of stimulating personal interest and fostering pride in the homeland. Such findings highlight the importance of offering diverse event formats that encourage active involvement and individual internalization of patriotic values.

The preferences of students regarding the forms of holding military-patriotic events indicate their interest in events that are related to practical actions. Such events form feelings of pride and participation, because they are focused on direct interaction with the historical and cultural aspects of the Motherland.

In terms of personal experience, respondents most frequently

mentioned visiting museums and exhibitions, participation in military-patriotic clubs, attending meeting with veterans, involvement in search teams, and taking part in the military-sports game "Zarnitsa," competitions in military-applied sports (shooting, hand-to-hand combat) and participation in historical reconstructions.

The majority of students (70%) assess the quality and level of military-patriotic events held at the Siberian State University of Physical Education and Sports positively. This result emphasizes the importance of constant analysis and improvement of the formats of military-patriotic actions for deeper involvement of young people and strengthening of patriotic values.

As an improvement in the organization and conduct of military events in Siberian State University of Physical education and sports, students expressed the following proposals: - involvement of famous athletes and veterans in the events; - organization of a system of incentives for the most active participants of events; - organization of joint events with other universities and organizations; - creation of a permanent club or volunteer base of participants.

The survey results indicate that most students demonstrate an interest in military-patriotic events. A significant proportion emphasized that participation in such activities contributes to the cultivation of patriotic values, a sense of pride in the homeland, and the strengthening of civic responsibilities.

The data obtained confirm that enhancing the effectiveness of military-patriotic initiatives in universities requires considering students' perspectives and tailoring programs and activities to align with their needs and expectations.

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The Effectiveness of Integrating Pulling Exercises into the Training System of Young Weightlifters Aged 12–14

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Abstract This article examines the effectiveness of incorporating snatch and clean pulls into the training process of weightlifters at the initial preparation stage. A pedagogical experiment substantiated the feasibility of partially replacing pulls with lifts of the barbell combined with a half-squat. This approach helps reduce the risk of injury and contributes to the more effective development of technical skills in second-year athletes.

Introduction A key issue in the development of weightlifting is the training system for athletes capable of achieving results at the international level, which is determined by the effectiveness of structuring the training process during the initial stages of long-term development [1]. One of the critically important stages in the long-term preparation of young weightlifters is the stage of preliminary basic training. Its main objectives are the development of stable motor skills in competitive exercises and the establishment of a foundation for general and specialized physical fitness, which is a necessary condition for the subsequent achievement of sports qualification standards [2]. In this regard, the optimization of training loads at this stage is of significant scientific and practical interest.

Problem Statement An analysis of current practice reveals a

widespread tendency to uncritically transfer training methods and tools used with qualified athletes to beginner training groups [3]. However, the level of functional and physical preparedness of weightlifters at the stage of preliminary basic training differs significantly from that of qualified athletes, which necessitates a strict alignment of training methods with their actual level of readiness.

According to standard training programs, snatch and clean pulls are already introduced during the first year of training [4]. It is well known that these exercises—especially the clean pull—are associated with extreme loads on the musculoskeletal system and, if applied incorrectly, may negatively affect the development of proper technique. This raises doubts about the appropriateness of their widespread use in the training process of beginner weightlifters.

Research Objective To determine the effectiveness of using snatch and clean pulls in the training process of young weightlifters during the second year of training, in comparison with alternative training methods.

Methods and Organization of the Study The following methods were used in the study: analysis and synthesis of scientific and methodological literature, pedagogical testing, pedagogical experiment, and methods of mathematical statistics. The research was conducted at the Youth Sports School «Zhasstar» in Aktobe. The experiment involved 20 weightlifters aged 12 to 14, who were divided into a control group and an experimental group.

Results and Discussion During the eight-week pedagogical experiment, which included preparatory and competitive mesocycles, a training methodology for the young weightlifters in the experimental group was tested. Instead of snatch and clean pulls, an equivalent volume

of barbell lifts in the snatch and clean with a half-squat was used. The training intensity in the classical exercises ranged from 60–80% of the athletes' maximum results during the preparatory period and 75–85% during the competitive period.

The obtained data indicate that using barbell lifts with a half-squat resulted in comparable development of pulling strength to that achieved in the group that performed specialized pulls. At the same time, the use of lighter loads (an average of 75% compared to 95% in pulls) contributed not only to the development of strength qualities, but also to improvements in speed characteristics and technical proficiency. This is due to the fact that working with submaximal weights in classical exercises more closely aligns with competitive performance and allows for more precise development of motor skills. Under conditions of rapid changes in anthropometric parameters in female athletes of this age (which lead to changes in grip and starting position), this methodology demonstrated higher effectiveness and lower risk of injury.

Conclusions Replacing snatch and clean pulls with barbell lifts in the snatch and clean with a half-squat during the preliminary basic training stage of the first year allows for a comparable increase in strength indicators. The use of lighter weights (on average 75% of the maximum load) in classical exercises, as opposed to pulls (95% of the maximum load), promotes the comprehensive development of not only strength but also speed, and creates optimal conditions for improving the technique of competitive exercises.

The proposed methodology is preferable in terms of minimizing injury risk and optimizing the development of motor skills in weightlifters aged 12-14, which ultimately enables a significant improvement in

competitive performance.

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Tensometry as a Method of Scientific Research in Sports

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Abstract This study explores enhancing scientific research methods in sports, emphasizing the strain gauge method's role in improving objectivity and precision. The research focuses on strain measurement in sports swimming, hypothesizing its utility for analyzing both motor abilities and swimmer technique elements. Objectives include studying the method's principle and its application for technical training improvement. Experiments at SSUPhES involved elite swimmers using specialized equipment for biomechanical analysis. Results demonstrate effective corrections in movement asymmetries, with future plans for long-term adaptation studies.

The relevance lies in the problem of improving the application of scientific research methods in sports. Every year, scientific research methods are being modernized, which offers significant potential for studying the application of scientific research methods in the sports field. Thus, the use of functional research methods makes it possible to study and adjust various types of training for athletes of any qualification. The use of the strain gauge method makes it possible to accurately study the

biomechanical parameters of an athlete's technique, as well as to adjust the performance of certain movements.

The aim was to find objective methods to improve the management process of swimmer's technical training.

Organization of research. The search for the necessary information was carried out in the process of studying literary sources on the Internet and in the SSUPhES library. Experimental studies of strain gauge recording of biomechanical parameters of swimming technique and swimmer's starting technique were carried out on the basis of the Department of Theory and Methodology of Water Sports of SSUPhES. Three masters of sports and a master of sports of international level participated in the exploratory research.

Currently, the strain gauge method is used in the practice of scientific research. This method allows you to register the efforts developed by an athlete while performing various physical exercises.

Strain gauges can also be used to determine the phase structure of an athlete's technique. In the process of performing athletic movements, an athlete exerts a mechanical effect on a wide variety of objects: a sports equipment, a floor, a track, which as a result experience deformations, registering which it is possible, by reference reactions, to judge the nature of athletic movement.

Strain gauge installation diagram includes a strain gauge, a converter of mechanical changes into an electrical signal, a strain amplifier and a recorder.

The history of using the strain gauge method began with the development of the first strain gauges based on the strain effect in 1938

and in 1947 from the moment of the first application of this method in physical research.

Strain gauge and strain gauge effect To register the forces developed and applied by an athlete to a support or to objects, load cells are used that convert mechanical deformation into an electrical signal. The load cell is a conductor with a diameter of 0.02-0.05 mm glued between two strips of paper. It is glued to an elastic element that perceives the force given by the athlete. The work of strain gauges is based on the strain effect. The strain effect is a change in the resistance of a conductor when it is lengthened. It is proved that the electrical resistance of the load cell (R) depends on the resistivity of the conductor (ρ), its length (l) and the cross-sectional area (S). It is calculated using the Ohm's law formula: $R=\rho l/S$. The electrical resistance of the sensor increases as it is stretched.

Application of the strain gauge method in swimming A special set of equipment was created at the Department of Water Sports, including: a load cell for rowing forces, a strain gauge, a comparator with a radio signal and a light indicator. This set of equipment allows you to set the degree of effort required on the comparator to smooth out the difference in the magnitude of the support reactions of the right and left hands, achieving uniform strokes, as well as to carry out rapid adjustments to the athlete's technique directly during training. The created tensoplateform and its electronic system made it possible to register three strain gauges, currently unique, which make it possible to make a biomechanical analysis of the effectiveness of the technique of pushing off the starting table and outline ways to improve it. With the help of the experiment, it was possible to smooth out the asynchrony of movements.

The use of the comparator allowed the athlete to quickly receive information about making mistakes using sound and, with the improvement of equipment, a light signal during the execution of swimming movements, as a result of which it was possible to make adjustments to the technique. It is worth considering that the main role was played by the effect of the athlete's urgent adaptation to the load. Subsequently, it is planned to conduct an experiment that will allow us to determine the time at which the effect of long-term adaptation affected the athlete's performance.

1. According to the literature, strain measurement, as a method of scientific research, is used in various sports. This method is most widely used in weightlifting, powerlifting, kettlebell lifting, athletics, gymnastics, swimming, rowing and skiing.
2. The principle of operation of the strain gauge method is based on the electrical recording of the degree of deformation of the strain gauge structure of a device for the study of selected indicators.
3. In sports swimming, the strain gauge method can be used to record dynamic and kinematic characteristics during swimming and during the swimmer's start, as well as to record the swimmer's maximum thrust in water and on land and strength endurance during swimming.
4. The strain gauge method makes it possible to correct swimming techniques by smoothing out the asymmetry of dynamic characteristics in the movements of the swimmer's hands.

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Comparative Characteristics of Professional Mma in Russia and the World

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Abstract The article is devoted to the analysis of the formation and institutionalization of MMA (Mixed Martial Arts) in the context of modern sports culture with an emphasis on the comparative study of the regulatory provisions of leading promotions.

The research problem includes the lack of a single global regulatory framework in MMA, which creates differences in the rules for fighting and training athletes.

The relevance of the study is due to the fact that modern sports culture is undergoing a stage of global transformation, characterized by the emergence of new sports, their commercialization, integration into the media industry and increased international competition.

The core of the study is a comparative analysis of the regulations of leading organizations (Unified Rules of MMA, IMMAF (International Mixed Martial Arts Federation), Russian rules, UFC (Ultimate Fighting Championship), ACA (Absolute Championship Akhmat)) makes it possible to identify both general principles (security control, points system, basic equipment) and significant differences (duration rounds, composition of equipment, participation criteria).

One of the most striking phenomena of the XXI century in this area was the development of mixed martial arts. Initially perceived as a

marginal combat show, MMA over the past two decades has turned into a full-fledged professional sport with millions of fans, high incomes, a well-structured structure and a system for training athletes. The development of MMA is especially intensive in countries such as the USA, Russia, Brazil, Great Britain and China.

Special attention deserves the fact that MMA in Russia and in the world is becoming more commercialized. Fights receive large financial injections, which allows organizers to offer high fees to athletes, make large-scale events and develop sports infrastructure. This creates a competitive environment where a good fighter can achieve success not only in sports, but also financially.

Comparative characteristics of the legal provisions of various promotions: Unified Rules of MMA (USA): - Duration of fights: professional fights consist of five minutes, between rounds - a break for one minute. - Scoring system: Three judges score each round separately, with the winner scoring 10 points and the loser scoring 9. If the round ended in a draw, both fighters receive 10 points.

According to Unified Rules, fighters must use approved light gloves (4-6 ounces), protective pads.

IMMAF Regulations (Sweden): - Duration of fights: fight consists of three rounds, each of which lasts three minutes, breaks between rounds - 60 seconds. - Professional participation: An athlete competing at a professional level is not eligible for IMMAF competition. - Mandatory gear: Competitors must use competitive gloves, shin protection, sports shorts and a rashguard made of durable material. The competition kit must be red or blue. - Match win: A match can end with a knockout, surrender of an opponent or TKO when the referee stops the match at his discretion

or on the advice of a doctor or team of athletes.

Rules of sport MMA (Russia): - Definition of MMA: it is a full-contact duel of two prepared athletes with application of shock and wrestling equipment in positions "rack" and "parterre." - Permitted techniques and actions: blows with a compressed fist on the opponent's body in the "stand" position; kicks to the opponent's body, legs and arms in the "stand" position; throws through the thigh and stalls from the "rack" and "stalls" positions; painful techniques (grips) on the joints of the hands, except prohibited, suffocating techniques, except prohibited. - Equipment: a tight-fitting T-shirt-rashgard made of synthetic material with a short sleeve, long or short wrestling shorts without locks, zippers and pockets, gloves with open fingers of at least six and no more than eight ounces with a rigid fixation of the wrist, a protective mouth guard for teeth, a band for groin protection, tight protective pads on the shin.

UFC (USA): - Duration of fights: a standard fight consists of 3 rounds of 5 minutes, the main fights of the evening and title fights - of 5 rounds of 5 minutes. Breaks between rounds - 1 minute. - Equipment: each fighter, when entering the octagon, must have 4-ounce gloves, a mouth guard and inguinal protection. If desired, the fighter can go to battle in ankle and/or knee supports. Clothing includes shorts for men and shorts, skirts and tops for women. Shoes are prohibited. - The outcome of the fight: ahead of schedule, the fight may end with a knockout, technical knockout, surrender or disqualification. If the fight passes all the allotted time, then the winners are determined by the judges. The decision of the judges may be unanimous, split or majority decision. - Scoring: all fights use a ten-point scoring system. Three judges count points each round, evaluating the skill of the fighters. The winner gets 10 points, the loser

gets 9 or less. Also, glasses can be removed for violations.

ACA (Russia): - Duration of duels: title fights last 5 rounds of 5 minutes with a break of 1 minute, rating and others - 3 rounds of 5 minutes with the same break. - Mandatory protective equipment: fighters use gloves, mouth guard and bandage (groin protection). - Determination of the winner: it can be a knockout, technical knockout, decision of judges or voluntary surrender.

Conclusion The commercialization of sports opens up new opportunities for fighters and organizations: the growth of fees, sponsorship contracts, large-scale events. Comparative analysis of the rules demonstrates a tendency towards unification, but retains national and organizational features, which forms a competitive variety of promotions. The practical significance of the study lies in the possibility of using conclusions in the development of training programs for athletes, as well as in improving the regulatory framework and adapting international experience.

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Old Slavic Games in Physical Education Classes at the University

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Abstract Folk games are preserved and passed down from generation to generation. They incorporate the best national traditions and reflect the distinctiveness and uniqueness of centuries-old Russian culture. The history of each game is unique and traces its roots back to ancient times.

The aim of the experiment was to improve the indicators of coordination abilities while serving the educational purpose of preserving cultural heritage. Such activities create conditions for the revival of folk gaming traditions and help make the activity meaningful and useful. Folk games remain relevant and interesting today. They can be used both in the classroom and during free time with the family.

Forty-two students participated in the experiment. Classes were held from October to May of the academic year. Initially, classic tests to determine coordination skills were used.

- 1) running in a snake pattern;
- 2) shuttle run 3×10 m;
- 3) shuttle run 4×9 m with successive carrying of two cubes behind the starting line;
- 4) throwing a ball at a target from different distances and from different starting positions.

The general external indicator of this ability is the degree of postural

stability, determined by the very fact of maintaining a given body position under conditions that make it difficult to maintain balance, by the magnitude of deviations of the body position from the given position, as well as by the fact of eliminating deviations and time [1].

Classes were held from October to May of the academic year.

At the end of each class, students were invited to play ancient Slavic games: vybivali, gorelki, salki, and gorodki [2].

A comparative analysis of the initial and retest results showed the following results:

- In the first test exercise, more than 50% of participants' results decreased from 22-25 seconds to 15-16 seconds;
- In the second, from 11-12 seconds to 8-10 seconds;
- In the third, from 14-17 seconds to 10-13 seconds.
- In the fourth, accuracy increased from 4 hits to 7-8.

These changes demonstrate positive dynamics in the change in the level of motor abilities of students.

Based on the experimental results, it can be concluded that using ancient Slavic games as a learning tool addresses a number of important social issues, such as developing coordination skills and preserving the cultural heritage of the Slavic people.

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On The Methodological Conditions of Cognitive-Motor Training of Athletes in Rhythmic Gymnastics

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Abstract The core in the manifestation of athletes' coordination abilities in rhythmic gymnastics is a combination of cognitive (such as memory, attention, reaction speed, and thinking) and motor functions, on which the expressiveness and plasticity of movements largely depend.

Historically, motor skills and cognitive functions have been considered separately, but their relationship is beyond doubt. The brain gives the command to perform absolutely any, even the most insignificant actions and movements of a person. The flexibility of cognitive thinking is a necessary component of the ability to make quick decisions when switching from a mental task to a motor task, switching from one thought to another, and thinking about several actions simultaneously [1]. When a person is tasked with completing several tasks over a period of time, in most cases it is a matter of quickly switching thinking. The fact that switching between multiple tasks leads to lower productivity due to the time spent switching becomes quite expected. In addition, different tasks may include different perceptual attributes and objects of perception, such as letters and numbers, colors and shapes [2].

Due to the peculiarities of rhythmic gymnastics, the use of two tasks during training can be useful because it requires simultaneous perception of appropriate signals and the performance of technical actions [3]. During

performances, athletes need to distribute their attention between numerous important signals, respectively, the ability of athletes to cope with two or more tasks at the same time differs from the ability of people who do not engage in sports, and requires deeper study.

Based on the goal of developing athletes' coordination abilities in rhythmic gymnastics, a promising approach is an activity aimed at simultaneously performing two tasks, one of which is aimed at engaging cognitive abilities, and the second at motor activity [3]. Depending on the level of interrelation of motor and cognitive tasks in such an activity, two options can be distinguished. The first option is with the display of abilities, when the motor task is the main and well-developed one, and the cognitive (additional) task distracts and does not have a direct effect on the result of performing the movement. The second option is especially relevant for athletes in rhythmic gymnastics, when a cognitive task is a prerequisite, without which it is impossible to perform a motor task, which is also difficult if you scan the space and orient yourself in it (for example, walking between cones in a predetermined order).

In this regard, it is logical to turn to cognitive-motor training of coordination abilities from the point of view of objective rationalization to make optimal decisions in a variety of motor activities. Moreover, the primary goal of such tasks is to solve both motor and cognitive tasks at the same time. In addition, it has been established that there is a positive transfer of acquired skills and abilities within the framework of such training sessions to other areas of activity, the tasks in which are completely new and unfamiliar [4].

Most researchers who have tried to study the importance of cognitive skills have done so using simplified paradigms that isolate cognitive skills

from others [5]. But removing key elements and limiting the environment can provoke subjects to engage in processes that they usually do not use or cannot use to solve a competitive task, which reduces the likelihood of identifying specific cognitive abilities, as well as how the underlying processes interact and are mediated by experience. [6-7].

The isolated development of these components can lead to an imbalance: for example, a well-coordinated athlete can get lost in unpredictable situations, while an athlete with a high level of cognitive functions will have time to realize his decision in the process of performing motor actions. The combined development of cognitive motor skills will contribute to the formation of a functional relationship: movements should become more meaningful in anticipating scenarios of action, and decision-making should be more operational, almost intuitive.

Taking into account the importance of cognitive-motor potential in increasing the level of fitness of athletes in rhythmic gymnastics, it can be assumed that cognitive-motor training of coordination abilities using interactive feedback simulators and objects that differ from standard ones in gymnastics in weight and shape – tennis balls, kinesio balls, medballs, gymnastic poles, balancing pads, support blocks, colored jumping rings, etc. it will be very effective. Based on this concept, when designing exercises for cognitive-motor training, it is necessary to adhere to the following methodological conditions: 1. The tasks to be solved in the process of completing tasks must be mutually conditioned (i.e., the solution of one is impossible without solving the other). An example of such a condition may be: movement along a previously unknown trajectory, the next position of which is determined in real time in the form of a visual signal, a verbal comment, or based on solving a logical

problem. 2. Assignments should be designed in such a way that optimal conditions are maintained for the development of flexibility of thinking, perception and adaptation to solving several tasks simultaneously. For such purposes, several types of sensory channels (for example, visual, auditory, and tactile) can be used simultaneously, where each type signals the need to perform a specific action scenario. 3. Exercises should have a degree of difficulty, where each level of difficulty should correspond to the current abilities of the student and change as progress appears. Increasing the level of complexity can be achieved by: introducing time constraints on decision-making, which increases cognitive load and trains the speed of information processing; adding inventory as a confusing factor; increasing the number of signals for memorization, etc. 4. The work should be carried out in a controlled training environment that can be dynamically changed to create various training modes: when interacting with feedback simulators that help solve a motor task; eliminating the human factor in an objective assessment of the level of developed abilities. 5. Cognitive-motor training should be integrated into the overall system for developing athletes' coordination abilities and conducted on a regular basis, monitoring the dynamics of results through feedback on recorded changes in trained ability components, which increases motivation to move on to exercises with a higher level of difficulty.

The above methodological conditions of cognitive-motor training reflect the idea of a modern systematic and scientifically based approach to the development of athletes' coordination abilities in rhythmic gymnastics. The mutual conditioning of motor and cognitive tasks, multisensory stimulation, gradation of complexity, a controlled training

environment and the integration of training into the overall training system reflect the perspective for the purposeful and multifaceted development of athletes' coordination abilities. Providing such conditions will not only increase the effectiveness of the training process, but also ensure the objectivity of assessing the level of development of coordination abilities, as well as increase motivation for the process of self-improvement. Thus, cognitive-motor training is becoming an important component of the modern training system aimed at the comprehensive development of athletes.

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Features of Determining the Level of Special Physical Fitness of Trampolinists

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Abstract The article presents the results of a study aimed at identifying and evaluating various parameters of flexibility development in trampoline athletes. Analysis of the obtained results, reflecting the average level of local flexibility development of athletes, indicates the need to optimize the training process of trampoline jumpers at the initial stage of preparation in terms of special physical training.

Relevance of the research. Sports training in the complex coordination sport of trampoline jumping, which emerged as an independent sports discipline in the last century, is a consistent, multi-year and complex process, the main components of which at the initial training stage are the correct management of the training process of those involved, technical and special physical training of athletes [2, 3].

The development of flexibility has a significant impact on the effectiveness of athletes' competitive activities and is one of the priority areas of special physical training for beginning trampoline athletes. Specialists emphasize the importance of incorporating methods to actively enhance flexibility during the early training phase, which

typically begins at ages 7-8, coinciding with a sensitive period of rapid growth and flexibility development [1, 5, 7].

A sufficient level of mobility of joint links and elasticity of the ligamentous-muscular apparatus in trampoline jumping, firstly, is the basis for the development and improvement of priority motor qualities in this sport. Secondly, increasing the range of motion in local joint links of beginning trampoline jumpers helps to create the prerequisites for the most effective mastery of basic technical combinations in this sport. Consequently, the development of flexibility of trampoline jumpers, in addition to a positive effect on the level of their technical training, in the long term is necessary to reduce injury rates typical for beginners in trampoline jumping and improve athletic performance [1, 4, 6].

Materials and methods of research The study was organized by the Omsk Region Trampoline Federation, involved 16 males who were engaged in trampoline jumping at the initial training stage. The age of the subjects ranged from 7 to 8 years. The methods used in the research: analysis of scientific literature, pedagogical testing, methods of mathematical statistics.

The level of flexibility development was determined by the following tests: spinal mobility (tests «Bridge», «Bend on the floor», «Bend on a gymnastic bench», «Birch», «Lunge with arch»), shoulder girdle (test «Lunge with arch»), mobility of the hip joints (tests «Longitudinal split», «Bound Angle Pose») and ankle joints (tests Bound Angle Pose», «Foot Flexion»).

Research results and discussion Based on the test results, an evaluation scale was compiled, which made it possible to determine the

level of development of various flexibility parameters of trampolinists at the initial training stage.

To determine the qualitative characteristics of the level of flexibility development of the subjects, a point assessment system with a calculated gradation was used, according to which all the obtained indicators were assigned grades on a scale from 2 to 5, that is, «unsatisfactory», «satisfactory», «good» and «excellent». The formed model characteristics of the level of flexibility development of trampolinists at the initial training stage were determined based on the actual test results using a computational scheme.

The analysis of the test results allowed us to determine that the level of flexibility development of trampoline jumpers at the initial training stage is heterogeneous in various indicators. For example, the worst results were achieved by the subjects in holding the Birch pose (average score – 3.38 ± 0.87), and the best result was obtained when the athletes performed the «Bound Angle Pose» test (average score – 3.94 ± 0.90). However, the average score obtained by trampoline jumpers for each control test is below 4 points, which indicates that the overall level of flexibility development in the trainees is insufficient.

After assessing the quantitative results in points according to the developed scale (assessment criteria), in order to identify the local level of development of flexibility of the students, a *qualitative indicator* of the subjects' performance of each test was determined. The *qualitative indicator* was calculated based on the number of subjects whose scores according to the results of the control event were high, that is, «4» or «5». In this way, when subjects received low scores according to the test results, such as «unsatisfactory» or «satisfactory», passing the test was

considered «unsuccessful». While the total number of good and excellent grades given to subjects after the implementation of pedagogical testing reflected the degree of «success» in completing the test, expressed by a qualitative indicator. The lowest *quality indicator* was recorded for the results of holding the pose «Lunge with arms raised up and torso arched back», while the highest level of success was demonstrated by athletes when completing the test task «Bridge». The obtained result may be associated with the systematic use of the «Bridge» exercise by specialists in the training process of athletes, which is one of the main means of developing flexibility in beginner trampoline athletes.

By performing a comparative analysis between the qualitative indicator and the average score obtained for each test, the level of development of trampoline jumpers' flexibility in various joint links was determined. The level of mobility development of the spine, shoulder girdle, hip joints and ankle joints of trampoline jumpers at the initial training stage was determined as satisfactory, that is «below average».

Conclusion During the analysis of the data obtained following the results of the control event, it was recorded that the overall level of flexibility development of trampoline jumpers at the initial stage of training is reduced and is characterized by heterogeneity in various indicators. In addition, the analysis of the test results made it possible to determine and, using the developed scale, evaluate the local level of flexibility development of those involved. In this way, the level of mobility of all the studied joint links of the athletes - the spine, shoulder girdle, hip and ankle joints – was determined to be mediocre, which indicates the need to adjust the training process of novice trampoline jumpers.

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Analysis of Mechanisms for Assessing the Physical Fitness of the Population in the Republic of Belarus and the People's Republic of China

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Abstract The results of the study reflect an analysis of certain mechanisms for assessing the physical fitness of the population and the degree of involvement of older people in physical education and health activities in the Republic of Belarus and the People's Republic of China.

Introduction In the Republic of Belarus, as in other highly developed countries around the world, issues related to the involvement of older people in physical education and health activities are now becoming strategically important as a means of achieving sustainable development goals.

In the context of the ‘silver economy’, where older people are not only passive consumers of goods, works and services, but also actively participate in the economy of the state, the continuation of their effective labour and social activities is of great socio-economic importance.

In the People's Republic of China, the promotion of healthy lifestyles is a widespread issue, which is closely linked to the widespread use of the latest communication technologies. National fitness in China is aimed at comprehensively improving the physical condition and strengthening the

health of the entire population.

Thus, we believe that it is now becoming increasingly important to find methods and modern technologies to effectively promote a healthy lifestyle among older citizens, so that traditional negative factors such as a sedentary lifestyle, environmental degradation and psycho-emotional overload can be mitigated through the development of a universally accessible fitness industry.

The aim of the study was to conduct a comparative analysis of various mechanisms for regular monitoring and assessment of the physical fitness of the population and the degree of involvement of older people in physical education and health activities in the Republic of Belarus and the People's Republic of China.

Research findings The National Strategy for Sustainable Development of the Republic of Belarus for the period up to 2035 notes that, alongside education, the quality of health is a key component of human development.

Thus, in the long term, the main efforts are planned to be concentrated on creating the necessary conditions for a healthy, long life and an active period of life, as well as on forming the institution of active longevity.

In the current conditions of an ageing population, the task of ensuring a healthy, safe and inclusive life for senior citizens is becoming increasingly urgent.

It should be emphasised that physical education and sports play an important role in leading a healthy lifestyle.

The objectives of the State Physical Culture and Health Complex of the Republic of Belarus 'Ready for Labour and Defence' (hereinafter

referred to as the GTO complex) are: development of physical culture and sport, health improvement and physical education of the population, promotion of a healthy lifestyle through physical culture; development of a system of mass sporting events among various gender and age groups of citizens; focusing the population on the priority of a healthy lifestyle.

The GTO complex consists of three programmes: a physical education and health programme; a physical education and sports multi-event programme; and a programme to motivate and encourage participation in physical education and sports.

At the same time, the current physical fitness standards of the GTO complex for older people only include tests of physical abilities: pull-ups on a high bar or push-ups (men); lifting the torso from a supine position (women); standing long jump; six-minute run; 30 m run; forward bend from a sitting position. At the same time, there is no provision for age gradation of the population in gender and age groups over 60 years of age.

The experience of the People's Republic of China in improving and maintaining the physical fitness of the population, as well as in developing a foundation of vital and practical motor skills and abilities, appears to be very promising in this regard.

In accordance with the Healthy China Action Plan adopted for 2019–2030, by 2030, up to 40% of the population should be regularly engaged in physical activity.

The above plan also states that instructors should provide the public with proper fitness services in sports clubs to improve physical fitness and prevent injuries during recreational physical activities. It is noted that different groups of people need different methods of recreational training so that people engage in physical culture and sports moderately and

sensibly.

It is worth dwelling separately on the technology used by the Chinese population to take tests and meet standards included in the National Physical Fitness Standards.

It is quite telling that when measuring the physical fitness of the Chinese population, not only tests for physical development are used, but also tests to determine important anthropometric and functional indicators.

Thus, measurements of physical fitness in elderly people in China include the following measurements and tests: height; weight; body mass index calculation; body composition analysis (body fat percentage); spirometry; 2-minute leg lift; handgrip dynamometry; forward bend from a sitting position; 30-second squats; standing on one leg with eyes closed; choice reaction time.

It is immediately noticeable that for older people, there is a five-year age gradation of the population in gender and age groups after 60: 60-64; 65-69; 70-74 and 75-79 years. In this way, China maintains the motivation of older people to regularly engage in health-promoting physical activity.

Conclusions Our research shows that in order to achieve sustainable development goals, it is necessary to effectively use modern scientific knowledge in the field of physical culture and sport.

In order to improve and maintain the physical fitness of the population and develop a set of vital and practical motor skills and abilities, it is advisable to pay attention to the experience of the mechanism of regular monitoring and assessment of the physical fitness of the population used in the People's Republic of China.

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The Specifics of the Terminology of Fencing Equipment in English Literature and the Difficulties of Translating It into Russian

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Abstract This article examines the problems of translating fencing equipment terms and difficulties appearing while trying to translate them into Russian. The article examines the history of fencing and types of weapons used for it and traces the changes in term usage throughout the various stages of its history. This paper will be useful for students, Master Degree students, coaches and fencing sport amateurs.

The modern discipline of sport fencing is a result of centuries of developing the art of swordfighting. Fencing is usually associated with the times of epeés and foils becoming the main melee weapon. Long history of fencing created lexicon concerning this art in all its variety. The Romanic languages have contributed many fencing terms; other nuances are covered by Germanic languages, English in particular. This article outlines the variety of terms denoting fencing equipment and discusses problems of translating them into Russian.

The fights of previous centuries were unlike modern ones. The most regulated fights were trials by combat, featuring complex ceremonies, sacred vows and scrupulous check of equipment [1, p. 54]. In common

duels participants usually used similar weapons, but a duel often involved several types of weapons. They could either alternate or be used simultaneously. While modern bout supposes a single weapon, previous centuries often featured two-weapon fighting: one hand attacked, the other defended. The Englishmen favoured sword and buckler (a small round shield) [1, p. 45]. In the age of rapiers the off-hand used a dagger. Spanish and Italian fencers defended with a specially-made cloak [1, p. 74].

The bout equipment changed over time. Full plates caused the estoc, an armour-breaking sword with long and hard blade to appear [1, p. 2]. Firearms made plate armor obsolete, so epeés and rapiers replaced heavier blades; daggers became full-fledged secondary weapons, instead of being a coup de grace instruments. The absence of armour and necessity to protect wrist lead to the creation of rapiers with complex guards [2, p. 126]. The fencing technique changed from slashing strikes to thrusts [3, p. 192; 1, p. 267], and sabres got the role of slashing weapons.

Such changes caused new fencing traditions to appear. Sabre duels became quite popular at Heidelberg University. England developed “prize fighting”, where the participants were paid by spectators’ bets and donations. There were hundreds of such fights in London “Bear Garden” [1, p. 286]. Such a rich history created lots of terms that are often confusing. The first problematic term is the most general one: sword. The word itself is Germanic (Scand. swärd, Old Germ. svert, Old Eng. Swerd) [3, p. 187]. It is usually translated as “mech”, but it encompasses a variety of non-polearms with a long blade. For example, the term small sword (“malyi mech”) denoted an epee or rapier. Another name for them was cut-and-thrust sword, “mech dlya porezov and ukolov” [2, p. 122].

Even when a sword is discussed, the attributes may change the meaning significantly. Sword usually denotes a one-handed sword, used with a shield, e.g. types X-XII by E.Oakeshott [4, pp. 27-36]. However, two-handed sword/two-hander denotes a “dvuruchniy mech”, up to 150 cm long. [4, p. 479]. Longsword (“dlinnyi mech”), bastard sword (“mech-bastard”) or hand and a half sword (“polutorniy mech”) is a hybrid of aforementioned [1, 60], but is denoted by three terms depending on region or period. Broadsword (“shirokiy mech”) often confuses a Russian-speaking reader, as it denotes a “palash”, a weapon of later age with complex guard. [1, p. 345]. There are cases when the term itself does not change, but the notion does. E.g, a term flamberge denotes a weapon with a wavy blade. Earlier this term was applied to bastard and two-handed swords; in XVII century the same word denoted a kind of a wavy-bladed rapier, with a different guard form, for easier change of hands [3, p. 207]. The correct term would be flamberge rapier, but it was often shortened. Nowadays, the term is once again associated with two-handed swords.

The terms denoting the bout itself also changed. The Russian term “fekhtovanie” encompasses all types of melee (excluding knives). However, English differs. The term fencing was finally adopted in XVI century; it comes from defence, a Latin word, akin to Old French defens [5, 350]. It denoted self-defence with any weapon; thus we may meet combinations like spear fencing or two-handed fencing sword [1, p. 73].

The change of attitude and transformation of fencing into a sport changed this. Fencing began to denote using a epee, foil or light sabre. So, synonymous terms of swordsmanship and sword-fighting appeared, opposed to fencing as sport. Modern fencing generally uses three

aforementioned weapons (names borrowed from French). They replaced Germanic sword, and within sport fencing it is always used as fencing sword. Sabre – “sablya” – doesn’t give much problems, except structural differences between sport and combat sabres. Epeé (or epeé de combat, French borrowing) – “shpaga” – is different. The Russian term comes from Italian spada, that comes from Latin spathe, a word for longswords, opposed to short Roman gladius [4, p. 12]. So by origin “shpaga” is synonymous to longsword, but they differ in appearance and tactics. Modern fencing uses epeé for three-edged 90cm long weapon, the hardest and the heaviest of three weapons (up to 750g). But modern epeé and historic one differ, and the translations of Sword and the Centuries by A. Hutton and The Book of Swords by R. Burton, do not even seek an equivalent, using epeé de combat. [6, p. 323; 3, p. 205].

Foil presents real problems. Today it denotes a thrusting four-edged weapon with flexible blade, weighing less than 500g. Foil is usually translated as “rapira”. The same word is for rapier and it usually denotes an older weapon with quite a different fencing technique. The earlier literature applied foil to training weapons using it in various combinations, e.g. dagger-foil [1, p. 109], which can be translated only as “rapirnyi kinzhal”. These seemingly trivial changes may lead to serious problems with understanding text. E.g, a 1945 translation of Treasure Island constantly uses dirk to denote melee weapons. The original text states cutlass, a weapon of different size, methods and tactics.

So, a seemingly obvious lexical area has lots of nuances, that we must take into account, remembering both text specifics (including time of writing) and term differences between countries and cultures. A translator should pay extreme attention to the context and the historical period.

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On the Effectiveness of Using Friction Trainers as a Means of Specialized Strength Training for Hurdlers Specializing in the 400-Meter Distance

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Abstract This study presents the results of a pedagogical experiment on evaluating the effectiveness of using friction trainers as a means of specialized strength training for hurdlers specializing in the 400-meter hurdles distance.

This paper is devoted to the discussion of the results of a pedagogical study on the effectiveness of using innovative friction training equipment for organizing special strength training for female hurdlers specializing in the 400m hurdles.

Preliminary studies, conducted to identify the main biomechanical and pedagogical components of the technique for overcoming a barrier at the specified distance – elements of dynamic posture and control movements in the joints – allowed us to conclude that when pushing off, the elements of dynamic posture are limitations of mobility in the lumbar spine and in the knee joint. The main control movements of this phase of the exercise are the extension movement in the hip joint of the supporting leg, the flexion movement in the hip joint of the swinging leg and the extension movement in the ankle joint of the pushing leg [1; 2].

During unsupported movement, the main elements of dynamic posture in the unsupported phase associated with overcoming the barrier

should be considered as the limited mobility in the lumbar and cervical spine, and the main control movements should be rotational movements in the joints of the thoracic spine, rotational movements in the joints of the thoracic spine with simultaneous abduction of the pushing leg, rotational movements in the joints of the thoracic spine with the swinging leg straightened and bent at the knee joint, and circumduction reciprocating movements in the shoulder joints of both arms.

Based on the results of the biomechanical study, the parameters of joint movements were established and special exercises were developed that reproduce the main ones during the performance of strength exercises using the innovative friction trainers “Bison-T” and “Bison-U” [3; 4].

The aim of the study was to establish the effectiveness of strength training using the specified training equipment in terms of optimizing barrier overcoming techniques.

Research methods: pedagogical experiment and statistical processing of its results.

The educational experiment took place over a period of two months in the natural conditions of the educational and training process of hurdlers, carried out in accordance with the program [5] at the Chinese Institute of Athletics of the Beijing University of Physical Education.

The experimental group's training included exercises using friction trainers, applied in accordance with our previously developed methodology [1; 2]. The control group of athletes trained with traditional strength training equipment.

The dynamics of the results were monitored by measuring the time to overcome the barrier based on high-speed video recording (300 fps).

Statistical processing was carried out according to the classical

scheme with the definition of standard statistical characteristics for each group of athletes and subsequent testing of hypotheses about the reliability of differences in results [6].

Study results. Analysis of the initial data for both groups revealed no statistically significant differences in hurdle clearance time. In the control group, the result was 0.6075 ± 0.012 s, while in the experimental group, it was 0.6042 ± 0.016 s. The significance level of the differences in the overall means did not reach 0.05.

At the conclusion of the training period, a new test was conducted as part of the experiment, the results of which showed a significantly greater difference in the direction of the experimental group's advantage. Specifically, at the end of the experiment, the control group's barrier-breaking time was 0.6016 ± 0.012 seconds, while the experimental group's was 0.5858 ± 0.011 seconds. Statistical analysis of the results showed that the difference was statistically significant at a significance level of less than 0.05.

Conclusion As a result of the training cycle, both groups experienced a decrease in hurdle clearance time, indicating a positive training outcome. However, the experimental group cleared the hurdle on average faster than the control group (0.5858 sec versus 0.6016 sec).

Statistical analysis of the results, followed by hypothesis testing of the significance of their differences, revealed their presence at a significance level of less than 0.05. Consequently, the use of innovative friction trainers for specialized strength training of female athletes specializing in the 400m hurdles has led to an improvement in hurdle times and a corresponding optimization of the technique of this technical element.

The obtained data allow us to recommend friction trainers for use as a means of specialized strength training for hurdlers, allowing for the optimization of hurdle overcoming technique and leading to improved competitive results.

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The Impact of Environmental Differences on the Health Benefits of Winter Sports for Adolescents—A Comparative Analysis of Policy, Social, and Family Levels in China and Russia

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Abstract Objective As a distinctive sport that combines competitiveness with fitness, ice and snow activities hold unique value in promoting the physical and mental development as well as social adaptability of adolescents. Both China and Russia possess the natural conditions necessary for winter sports; however, due to historical traditions, stages of development, and cultural backgrounds, significant differences have emerged in the supportive environment for youth participation in these activities. This paper explores the impact of such differences on adolescents' engagement in winter sports and their associated health benefits by comparing the support environments in China and Russia across three dimensions: policy assurance, social support, and family awareness. The study aims to provide a reference for optimizing the health promotion system for youth winter sports in China.

Methods This paper employs three research methods. Firstly, the comparative research method is primarily used to conduct a horizontal comparison of differences between China and Russia in terms of policy support (coverage, enforcement, etc.), social support (availability of venues, community activities, etc.), and family awareness (participation attitudes, willingness to invest, etc.); as well as a vertical analysis of how

different support environments affect adolescents' participation frequency and autonomy in relation to health benefits (physiological indicators, mental state,etc.). Secondly, the literature research method is applied to review Chinese and Russian winter sports policy documents and relevant theoretical materials in academic literature concerning support environments and health benefits. Finally, the case analysis method is combined by selecting representative cities or social organizations from China and Russia (such as Northeast China and Sochi, Russia) to analyze the differential impact of their respective support environments on adolescents' health benefits from participating in ice and snow sports.

Results 1. Difference in support environments are significant. Russia has established a tripartite circular model through "national policy proposals, societal-wide dissemination, and family-based learning and integration." At the same time, the autonomy, initiative, and sense of accomplishment among adolescents are key characteristics, enabling widespread participation in winter sports within the youth population, which greatly benefits their physical and mental development. China, on the other hand, is in the stage of "policy-driven by the state, disseminated by social organizations, with trial participation at the family level." Adolescents do not participate spontaneously but mainly engage through social organization activities, and the health benefits cannot achieve long-term growth due to the instability of the support environment. 2.Differences in health outcomes for adolescents. Russian adolescents, due to long-term participation, exhibit stronger physiological attributes such as cardiopulmonary function and cold endurance, as well as superior psychological traits like teamwork and resilience, with significantly enhanced social adaptability. Chinese adolescents' health benefits are

primarily concentrated on short-term physical fitness improvement and interest stimulation, with limited improvement in long-term indicators such as cold endurance and psychological resilience, and there are regional and group-based disparities.³ Experiences from both countries can be mutually referenced. Russia's systematic policies, public-oriented social resources, and family-integrated approach provide China with a reference for long-term mechanisms; China's practice of leveraging large-scale events to promote policies and activate commercial markets can inject vitality into Russia.

Conclusions The promotion of youth health through winter sports essentially reflects the support for environmental systematization and sustainability. In the future, China needs to advance the deep integration of winter sports with school education at the policy level, expand the provision of public resources socially to balance regional disparities, and cultivate the concept of incorporating winter sports into daily family life. This will achieve a coordinated upgrade in environmental support, enabling winter sports to become a long-term empowering vehicle for the physical and mental development of young people.

Keywords: Winter Sports; Youth Health; Policy; Society; Family

Orientation and Path of Constructing College Students Sports Values in the Perspective of Active Health

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Abstract Research Objective: Under the background of the deep advancement of the "Healthy China" strategy and the concept of "Active Health," sports have transcended the singular function of physical exercise and become an important carrier concerned with individual health management, social responsibility awareness, and cultural identity. As a core group of youth, college students' sports values not only influence their healthy lifestyles and behavioral choices but also have profound significance for the future development direction of social sports culture. However, existing research mostly focuses on single-point analyses of sports participation behavior or health education, lacking a systematic exploration of the generation logic and construction pathways of college students' sports values within the overall framework of active health. This study aims to fill this gap and explore the basic orientation and development paths of constructing college students' sports values from the perspective of active health. Research Methods: This study is based on health communication theory, value theory, and the concept of active health. Research methods such as literature review and questionnaire surveys were employed to clarify the theoretical context of constructing college students' sports values through a review of relevant domestic and international research findings. Combining survey and interview data, the study analyzes characteristics and internal logic of college students' cognition, attitudes, and behaviors regarding sports. At

the same time, using qualitative analysis methods, the formation mechanism of college students' sports values is revealed from three aspects: social environment, media communication, and individual awareness. **Results and Analysis:** The study found that, first, college students' sports values generally exhibit multidimensional features. Most students generally recognize the health-promoting role of sports, but at the level of practical implementation, There is still a gap between value recognition and behavior execution. Second, the pathway of generating sports values shows multi-level and interactive characteristics. At the macro level, policy advocacy and media communication shape the public discourse environment of sports values; at the meso level, campus culture and interactions with peer groups reinforce value identification; at the micro level, individuals' active health awareness to some extent promotes the internalization of sports values. Third, the current sports values of college students tend to be utilitarian and superficial. Some students emphasize the immediate benefits of sports in body shaping and social interaction, while paying insufficient attention to sports' role in spiritual cultivation, character building, and long-term health value. Fourth, the concept of active health has a certain level of recognition among college students, but overall, there is a lack of systematic guidance and sustained mechanisms, resulting in a fragmented and phased construction of sports values.

Conclusion and Recommendations: The study suggests that in the perspective of proactive health, the construction of college students' sports values should adhere to three main orientations: health-oriented, holistic development, and cultural awareness. First, the health-oriented approach requires viewing sports as an important component of an active,

healthy lifestyle, guiding college students to incorporate sports into their personal health management system. Second, holistic development emphasizes avoiding one-sided utilitarianism, highlighting the comprehensive value of sports in physical health, psychological adjustment, character cultivation, and social responsibility. Third, cultural awareness requires integrating the construction of sports values with excellent traditional Chinese culture, contemporary youth spirit, and international health concepts, promoting a pluralistic and inclusive value system. Based on this, the study proposes: First, optimizing health communication mechanisms. It is necessary to strengthen the coordination between authoritative institutions, media, and universities, enhance the scientific accuracy and relevance of sports communication content, and promote college students' scientific and rational understanding of sports. Second, strengthening campus sports culture construction. By improving curriculum systems, enriching club activities, and creating a healthy atmosphere, college students can gradually internalize sports values in their daily practice. Third, improving policies, systems, and social support. Governments and universities should ensure the continuous cultivation of college students' sports values through better facilities, resource allocation, and incentive mechanisms. Fourth, highlighting individual subjectivity. Through proactive health education and personalized guidance, college students' autonomy and sense of responsibility in sports practice should be stimulated, achieving a shift from "passive acceptance" to "active recognition."

Investigating the Influence Path of Sports Culture on Adolescents' Health Behaviors: A Dual-Mediation Analysis Based on Sports Concepts and Health Awareness

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Abstract: To explore the influence mechanism of sports culture on adolescents' health behaviors, this study constructed a dual-mediation model. With 518 junior and senior high school students as samples, the study adopted the questionnaire survey method and structural equation modeling (SEM) for analysis.

Results Sports culture exerted a fully mediating effect on health behaviors through sports concept (mediating effect = 0.18, 95% CI [0.11, 0.26]) and health awareness (mediating effect = 0.21, 95% CI [0.14, 0.29]), while the direct effect was not significant ($\beta = 0.05$). Additionally, the mediating effect of health awareness was slightly stronger than that of sports concept. Conclusions: Sports culture needs to indirectly promote adolescents' health behaviors by enhancing their sports concept and health awareness. It is suggested to create a sports culture environment to strengthen their internal psychological pathways.

Keywords: Sports Culture; Adolescents; Health Behaviors; Dual Mediation Analysis

Cultural Ecology of Recreational Diving: Composition and Evolution

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Abstract Recreational diving, as a comprehensive cultural activity that integrates sports, tourism, and ecological experiences, has experienced rapid global expansion in recent years. This study systematically employs cultural ecology theory to analyze recreational diving culture, constructing an analytical framework based on three dimensions—cultural generation, inheritance, and existence—alongside the three layers of cultural patterns (material, institutional, and spiritual). This framework elucidates the compositional elements and evolutionary mechanisms of recreational diving culture, offering a novel perspective for understanding this phenomenon. The study also provides theoretical guidance for the sustainable development of diving culture and practical insights for achieving human-nature harmony.

Using methods such as literature review, expert interviews, and case analysis, the research reveals that recreational diving culture originated from ancient human aquatic practices and underwent functional transformations—from a production tool to military applications and eventually to a leisure activity. At the material level, equipment has evolved from simple devices to modern intelligent systems, demonstrating trends toward lightweight, smart technologies that enhance safety and accessibility. Institutionally, a multi-tiered organizational system has emerged, encompassing experiential diving, training

certification, tourism diving, and competitive frameworks, supported by comprehensive industry standards. Spiritually, the culture emphasizes reconnecting with life's origins, fostering personal development, and promoting humanistic values, thereby encouraging harmony between participants and the marine environment.

The study identifies three key evolutionary trends: 1. Recriminalization, reflected in the popularization of participation motives, lightweight equipment design, and diversified activity formats. 2. Educationalization, evident through standardized safety training, diversified health education and deepened aesthetic awareness. 3. Intelligentization, driven by smart gear adoption, data-driven management, and integrated eco-friendly technologies. These trends collectively propel recreational diving culture toward safer, more environmentally sustainable development. Notably, AI empowerment is becoming a defining feature. Intelligent devices enable real-time monitoring of environmental parameters and marine life identification, allowing divers to intuitively recognize marine ecological fragility and adopt proactive conservation behaviors. IoT-based monitoring networks provide scientific support for managing environmental capacity and diver activities, shifting conservation models from traditional moral constraints to technology-enabled, data-driven approaches.

Supported by national strategies such as the Belt and Road Initiative and sports industry policies, recreational diving demonstrates strong growth potential. The Asian Diving College—established jointly by Lingnan Normal University and the Zhanjiang Diving Sports School—is the world's first diving college within a comprehensive university, addressing the global gap in undergraduate diving talent cultivation. Moving forward,

recreational diving culture will continue to evolve through technological empowerment, ecological protection, and cultural integration, serving as a critical practice for advancing harmony between humanity and nature.

Keywords: Recreational diving culture, cultural ecology, evolutionary trends, intelligentization, sustainable development

Research on Opportunities, Challenges and Paths for Promoting Teenagers' Sports Health under the Background of the "Double Reduction" Policy

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Abstract Objective This research aims to systematically explore the multiple opportunities and challenges brought about by the implementation of the "Double Reduction" policy for promoting teenagers' physical health. By deeply analyzing key factors such as the distribution of students' after-school time, shifts in social attitudes, and the reallocation of educational resources under the policy context, this research will comprehensively identify the positive signals and constraints that arise during the policy implementation process. Special attention will be paid to dimensions such as school physical education reform, innovative family sports participation models, and social resource integration mechanisms, with the goal of constructing a multi-party collaborative sports health promotion system. This will provide comprehensive theoretical basis and practical guidelines for educational administrative departments to formulate supporting measures, schools to optimize their physical education work plans, and families to change their health education concepts, ultimately promoting the all-round physical and mental development of teenagers.

Methods This research mainly employs the methods of literature review, logical analysis, and systematic induction. Firstly, it systematically collects relevant policies and literature; secondly, it

logically analyzes the current predicaments and development opportunities under the background of "double reduction"; finally, it systematically summarizes and integrates viewpoints to construct a multi-party collaborative path for promoting physical health.

Results Through analysis, it was found that the main opportunities brought about by the "double reduction" policy include: students' after-school time has significantly increased, providing necessary time guarantees for participating in sports activities; the importance of sports in society and families has reached an unprecedented level; the status of sports in the primary and secondary school education system has been strengthened. At the same time, the challenges are also very prominent: many schools are facing the problem of insufficient sports teachers and facilities; parents' emphasis on sports may still be at the conceptual level and lack effective guidance methods; and issues such as how to establish a scientific and diverse sports evaluation system. The analysis suggests that the opportunities are unprecedented, but the challenges are real. Thus, seizing the opportunities lies in implementing systematic solutions to ensure that they are transformed into visible and tangible practical results.

Conclusions This study holds that the "double reduction" policy has created a historic opportunity for promoting the physical health of teenagers. However, to transform this policy opportunity into substantive health benefits, systematic planning and diversified collaborative reform practices are urgently needed. Based on this, the following suggestions are proposed: Firstly, implement structured curriculum reforms at the school level, exploring the "class-by-class selection" model to accommodate students' varying interests; establish a "regional teacher sharing mechanism" and a "social force participation" model to alleviate

the shortage of teachers and venues. Secondly, at the family level, build an environment for active participation, carry out "parent-child sports" themed activities, and encourage parents to shift from conceptual recognition to behavioral accompaniment, integrating sports into family life. Finally, at the social level, integrate resources and improve the evaluation mechanism, promote public sports venues to be open to teenagers for free or at low fees, establish a "home-school-community" linkage network; at the same time, utilize information technology to build a digital evaluation platform, achieving a transformation from single result evaluation to comprehensive quality evaluation. Through these systematic measures, a co-education pattern led by schools, based on families, and supported by society will be formed, enhancing the effectiveness and sustainability of promoting teenagers' physical health.

Keywords: "Double Reduction" policy; Teenagers; Sports health promotion; Physical health; Collaborative promotion

Research on Innovation of China's After-School Sports Service Model Under the “Double Reduction” Policy from a Cross-Cultural Perspective

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Research Objectives Against the backdrop of the full-scale advancement of China's “Double Reduction” policy, the country's after-school sports services are confronted with challenges such as homogeneous content, shortage of professional resources, and weak sustainable development capacity. From a cross-cultural perspective, this study aims to achieve three goals through international comparative research: first, analyze the differentiated characteristics of after-school sports service models under different cultural backgrounds and their formation mechanisms; second, diagnose the structural problems and implementation dilemmas in China's after-school sports service system, and identify key factors affecting service quality and sustainability; third, explore and construct an innovative model that not only conforms to the characteristics of Chinese education but also integrates international experience and local needs, so as to provide a basis for policy improvement and practical optimization, and promote the high-quality development of after-school sports services.

Research Methods This study adopts a cross-cultural comparative analysis method. Based on the theoretical framework of cultural dimensions, it conducts a systematic comparative study on representative after-school sports service models in the United States, Japan, Northern

Europe and other regions.

Results and Analysis First, there are significant differences in after-school sports service models under different cultural backgrounds: North America focuses on market regulation and personality development, emphasizing students' ability of independent choice; Japan highlights the leading role of schools and disciplinary norms, cultivating the spirit of collectivism; Northern Europe emphasizes the public welfare attribute, promoting equal participation and social equity. Second, China's after-school sports service system faces three structural problems: excessive pressure on implementers, which affects service quality; insufficient integration of social resources, which limits the diversification of content; unbalanced regional service quality, which restricts educational equity. Third, it is necessary to construct a new collaborative mechanism among the government, schools and society, clarify the boundaries of responsibilities and cooperation models, and establish a sustainable development mechanism to promote the optimization and upgrading of the after-school sports service system.

Conclusions and Recommendations Based on the analysis of this study, the following recommendations are put forward to improve the quality of after-school sports services and promote the all-round development of students: First, construct a government-led diversified supply system. The government should improve policy support, supervision and evaluation mechanisms, provide institutional guarantees for after-school sports services, and ensure their standardized and standardized operation. Second, promote schools to transform from direct service providers to resource coordinators and quality supervisors. Professional social forces should be introduced to improve service

standards, while strengthening the leading role of schools in the service process. Third, guide the orderly participation of professional social forces. Establish qualification certification and access mechanisms, give full play to the advantages of social resources in professional talents and innovative models, and enrich the content and forms of services. Fourth, attach importance to regional development differences and implement differentiated promotion strategies. Ensure fair and accessible services through classified guidance and resource inclination, and promote the balanced allocation of educational resources.

By constructing a “tripartite collaboration” mechanism among the government, schools and society, the professionalization, diversification and sustainable development of after-school sports services will be finally realized, providing strong support for the healthy growth of teenagers.

Research on the Value and Application of Public Tai Chi in Health Promotion under the Healthy China Initiative in the New Era

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Research Objective With the ongoing implementation of the Healthy China strategy and the widespread promotion of the national fitness initiative, there is a growing need to further explore and systematize the health-promoting value of Tai Chi as a traditional Chinese physical activity. In accordance with the National Sports Administration's Key Tasks for Mass Sports in 2025 and the *15th Five-Year Plan for Sports Development*, which emphasize the effective delivery and popularization of Tai Chi instruction across different age groups and social segments, this study investigates the health promotion value of public Tai Chi within the context of the Healthy China initiative in the new era. It begins by clarifying the comprehensive fitness benefits of Tai Chi and underscores its role in enhancing individual health awareness, guiding health-promoting behaviors, and preventing disease. The study also addresses the importance of integrating Tai Chi into the national fitness service system through multiple avenues—such as families, schools, and communities—to maximize its health promotion potential. This research holds significant theoretical and practical value for advancing the Healthy China strategy, deepening the integration of sports and health services, and improving the overall health status of the population.

Research Methodology This study primarily employs the literature review method and logical analysis. By reviewing relevant scholarly publications, it synthesizes the current state of research on Tai Chi's role in health promotion. Through logical analysis, the collected literature is systematically summarized to elucidate the intrinsic mechanisms by which public Tai Chi contributes to health enhancement.

Research Findings and Analysis In recent years, there has been a notable increase in both domestic and international studies on the health benefits of Tai Chi, covering areas such as cardiovascular and metabolic health, musculoskeletal function, mental well-being, and chronic disease management. As a traditional cultural heritage with a long history and global reach, Tai Chi serves as a daily health practice that integrates physical and mental regulation, thereby supporting psychological wellness. Moreover, as a low-intensity aerobic exercise, Tai Chi contributes to improved cardiopulmonary function, enhanced physical coordination and flexibility, and better psychological regulation—particularly in reducing stress, elevating quality of life, and slowing disease progression. Its distinctive "mind-body unity" principle, embodied in the concept of "training the mind through the body and guiding the body with the mind," differentiates it from other forms of exercise and constitutes a unique health promotion mechanism. Accessible to individuals of all ages, including middle-aged and elderly populations, Tai Chi demonstrates specific benefits in improving balance and assisting in the management of chronic diseases.

Conclusions and Recommendations In the context of the Healthy China initiative in the new era, it is essential to integrate Tai Chi into community-based fitness prescription systems under the framework of

sports-health integration. Tailored Tai Chi programs should be developed for different demographic groups, such as adolescents, working women, and the elderly. Supportive policies should be introduced to strengthen the training of community sports instructors. Combining smart fitness technologies with "Internet + Tai Chi" guided training can help overcome traditional barriers to its promotion. Integrating Tai Chi into public health services—such as national physical fitness assessment and health management—will expand its reach within the public fitness service system and provide a sustainable, traditional physical activity solution to support the Healthy China strategy.

Keywords: Healthy China; Public Tai Chi; Health Promotion

Research on the Knee Muscle Strength Characteristics of High-level Wushu Routine Athletes Based on Isokinetic Muscle Strength Testing

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Abstract Objective With the continuous improvement of the competitive level of wushu routines, knee joint injuries are highly prevalent in wushu routine training or competitions. Therefore, scientifically evaluating its muscle strength function is a prerequisite for effective protection. Isokinetic muscle strength testing is an objective and commonly used knee joint biomechanical device that can provide methodological support for this. Therefore, this study aims to explore the specific muscle strength characteristics of the knee joints of high-level wushu routine athletes using isokinetic muscle strength testing, identify the weak links in the development of the muscle strength of the flexor and extensor muscle groups, and formulate personalized muscle strength training and injury prevention programs for high-level athletes, in order to improve the athletes competitive performance and extend their sports lifespan.

Methods: This study will use the literature research method to understand the physical fitness requirements and injury conditions of the knee joints of high-level wushu routine athletes. Through testing 24 high-level wushu routine athletes for isokinetic muscle strength testing, using the American BIODEX (SYSTEM4) isokinetic muscle strength

testing and training device, isokinetic concentric testing is performed on the flexor and extensor muscle groups of both knee joints. The test results are used to conduct descriptive statistics, significance tests, and one-way analysis of variance on the collected data such as peak torque, relative peak torque, and the ratio of peak torque of the flexor and extensor muscles using SPSS statistical software, and the significance level is set to $P<0.05$.

Results The relative peak torque of the knee extensor muscles in wushu routine athletes was significantly higher than that of the flexor muscles, indicating muscle strength imbalance. Moreover, as the test angular velocity increased (from $60^{\circ}/s$ to $240^{\circ}/s$), the torque values of both the flexor and extensor muscles showed a significant downward trend ($P<0.05$), and there was no significant difference between the bilateral knees. In addition, the peak torque ratio of the knee flexor and extensor muscles (H/Q) increased significantly with the increase in angular velocity and reached the highest at $240^{\circ}/s$ (left knee $86.29\pm10.11\%$, right knee $82.95\pm7.69\%$), indicating that the knee joint stability of athletes in rapid movement may be more dependent on the co-contraction ability of the flexor muscles. The analysis of the angles at which the knee flexor and extensor muscles reached peak torque showed that there were different optimal force application angles for the knee flexor and extensor muscles of the subjects. This quantitative characteristic was highly consistent with the movement patterns such as pushing and extending force and knee flexion buffer required in their specific techniques, reflecting the specific adaptation of the

neuromuscular system. The average power of the subjects increased significantly with the increase in speed, reflecting the excellent rapid strength ability of the athletes. However, the decrease in total work indicated limitations in muscle endurance at high speeds.

Conclusion: This study revealed the specific muscle strength characteristics of the knee joints of wushu routine athletes: the extensor muscle strength and power output were significantly dominant, but the rapid strength and muscle endurance decreased with the increase in speed; the flexion-extension muscle strength ratio (H/Q) was relatively low at low speeds, indicating relatively weak flexor muscles, and tended to functional balance at high speeds. At the same time, the angles at which peak torque was reached were consistent with the specific force application patterns, and the average power increased significantly with the increase in speed, reflecting a good adaptation to explosive movements. This comprehensively deepened the understanding of the biomechanical characteristics of the knee joints in this event and provided key empirical evidence for precise training and injury prevention and control.

From Traffic to Stock: A Study on the Long-term Mechanism of "Jiangsu Super League" Driving the Integration of Youth Sports, Education and Health

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Abstract At the critical stage of the in-depth advancement of the "Healthy China 2030" Strategy, the sustainable development of the integration of physical education and health for adolescents is facing challenges. Taking the Jiangsu Urban Football League as a case study, this paper focuses on how to transform the explosive popularity of the event into a powerful driving force for the sustainable development of the integration of physical education and health for adolescents after its sudden rise. The aim is to provide a replicable and promotable reference model for similar regional sports IPs across the country to deeply empower education and health undertakings. Based on this, the research adopts the case-analysis method and the mechanism-sorting method. Combining the practice data of the "Jiangsu Super League" (JSL) in multiple cities in Jiangsu Province (such as the participation rate of campus football, the academic performance of football specialty students, and the physical fitness monitoring data of adolescents), it explores an internal transformation chain of "event traffic- institutional mechanism - integration ecosystem" and analyzes a sustainable development path to drive the integration of physical education and health for adolescents. The research findings are as follows: At the level of multi-subject

collaboration, the "Jiangsu Super League" integrates the forces of the government, schools, enterprises, families and other parties, clarifies the roles and responsibilities of each party in the integration of physical education and health, and forms a collaborative pattern of policy guidance, resource supply, implementation, and social participation. This ensures that the policy support and resource investment required for the integration of physical education and health can be stably and continuously tilted towards the adolescent group, avoiding development disruptions caused by the efforts of a single subject. At the level of resource recycling and feedback, the "Jiangsu Super League" breaks the traditional model of "unidirectional resource output" in events and constructs a positive cycle of two-way empowerment between "sports IP and campus ecosystem". On the one hand, it sinks the professional resources and platform advantages of the event to the campus to support the integration of physical education and health in schools. On the other hand, it discovers talents and accumulates data through campus physical education and health integration practices to feed back into the development of the event itself, enhancing the internal driving force of the physical education and health integration system. At the level of dynamic evaluation and optimization, the "Jiangsu Super League" establishes an effectiveness monitoring system covering multiple dimensions of physical education and health integration. It uses evaluation tools to track the progress of integration, promptly identify problems and deficiencies, and adjust strategies and mechanisms accordingly. This ensures that the integration of physical education and health meets the development needs of adolescents and guarantees the stable improvement of integration effectiveness. The research shows that

the "Jiangsu Super League" uses events as a hub to empower the growth ecosystem. Through three paths of ladder-type event connection, learning-training coordination guarantee, and full-dimensional health services, it solves the pain points in traditional adolescent sports development and transforms the event influence into a long-term driving force for adolescent health promotion. In the future, we can continue to build a "multi-collaborative governance framework" to implement the responsibilities of the government, schools, enterprises, and families, avoiding the "single-subject solo fight". Strengthen the construction of the "internal resource recycling mechanism" to improve resource utilization efficiency through two-way feedback and reduce dependence on external temporary resources. Improve the "continuous evaluation and feedback system" and dynamically optimize strategies based on data to avoid the decline in effectiveness caused by "extensive promotion". In short, only by coordinating mechanisms, resources, and evaluations with a systematic thinking can we promote the organic integration of adolescent sports, education, and health and provide solid support for the implementation of the "Healthy China" Strategy among adolescents.

Keywords: Jiangsu Super League (JSL); Adolescent Physical Education and Health Integration; Event Traffic Transformation; Multi-Subject Collaboration; Regional Sports IP

Research on the training path of multi-functional sports and health talents under the background of high-quality development of ice and snow industry

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Objective In the era of deep integration between high-quality development of the ice and snow industry and the national fitness strategy, this study focuses on the precise convergence point between the sports and health talent cultivation system and the industry's development needs. It identifies systemic bottlenecks in the current process of cultivating interdisciplinary sports and health professionals, achieving a strategic transformation from "passive matching" to "active adaptation" in talent supply. The research facilitates a paradigm shift from "single-skilled" to "multi-skilled" capabilities, promoting the deep integration of sports and health talents into the high-quality development ecosystem of the ice and snow industry. This provides solid talent support for building a sports powerhouse.

Methods Document research, expert interviews, and logical analysis.

Results The cultivation of interdisciplinary sports and health professionals currently faces three critical imbalances. Structurally, the talent development system exhibits a "sports-focused over health-oriented" imbalance, limiting the diversity and adaptability of talent supply. Cognitively, society confronts three cognitive challenges:

competence perception bias, ambiguous career positioning, and disconnect with industry demands, which hinder the realization of talent value. Mechanically, the talent development chain and winter sports industry demand chain remain uncoordinated, with an incomplete "education-training-employment" closed loop that undermines sustainability. To address these issues, this study proposes a "four-dimensional synergy" cultivation framework: Institutional synergy involves establishing a "national leadership-regional coordination" governance structure, formulating standards and incentive policies for interdisciplinary sports and health professionals, and creating cross-regional talent collaboration mechanisms. Resource synergy focuses on building a "regional complementarity-industry integration" educational network, where northern regions leverage winter sports resources for practical training while southern regions utilize health technologies for technical advancement, forming a "north-south linkage and industry-education integration" resource layout. Competency synergy implements a "skills-health-culture" integrated development program, developing interdisciplinary competency curricula and cross-domain adaptability modules to cultivate professionals' comprehensive capabilities. Mechanism synergy drives multi-sector integration across "winter sports-health- education- industry", forming a value-added closed loop of "competition-driven growth-industry feedback-talent development".

Conclusions To cultivate interdisciplinary sports and health professionals for the ice and snow industry, we must transcend traditional educational paradigms by implementing a three-dimensional dynamic optimization model to ensure precise and high-quality talent supply. Key

recommendations include: 1) Strengthening industry demand orientation through establishing dynamic monitoring and early warning mechanisms for talent needs; 2) Restructuring educational content systems by developing interdisciplinary competency modules; 3) Enhancing collaborative governance mechanisms to build a multi-stakeholder training ecosystem featuring "government guidance, corporate participation, institutional implementation, and social evaluation"; 4) Deepening digital empowerment through intelligent training platforms to improve competency development precision and efficiency. By systematically optimizing talent cultivation mechanisms, we can achieve dynamic equilibrium between industry talent supply and market demands, providing sustainable human capital support for high-quality development of the ice and snow industry, thereby advancing the strategic goal of building a sports powerhouse.

Keywords: ice and snow industry; multi-skilled sports and health professionals; high-quality development

Research on Optimising Olympic Preparation Strategies for Artistic Swimming Based on Multi-source Data Fusion and Adversarial Simulation

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Abstract Objective Confronted with World Aquatics' latest rule cycle that re-orientates artistic swimming from a performance art to a hybrid “technique–art–tactics” contest, this study constructs a data–game dual-driven framework to dissect Olympic preparation strategies and to reveal the synergistic mechanisms among decisive performance factors, thereby furnishing evidence-based decision support for the Chinese team's Los Angeles 2028 campaign.

Methods An end-to-end “acquisition–quantification–simulation” pipeline was built on 326 routines skated between 2019–2024.

(1) Multi-source capture: above-water LiDAR and underwater stereo-vision were time-synchronised to yield 3-D trajectories; IMU pods and computer-vision toolkits extracted kinematic signatures; ArtScore Pro quantified artistic components.

(2) Strategic modelling: a dynamic game-theoretic decision tree integrating Markov Decision Process (MDP) and Monte-Carlo Tree Search (MCTS) was deployed for adversarial simulation.

(3) Referee analytics: NLP parsing of official English/French/Spanish commentaries converted latent scoring

preferences into regional weight vectors.

(4) Validation: official metadata cross-check and double-blind annotation guaranteed construct validity (Cohen's $\kappa = 0.83$).

Results & Analyses **Technique–art equilibrium under re-weighted rules** With technique and art now equally weighted (5:5), China's "dual-coding" cultural narrative improved heritage-score stability ($\Delta SD = -1.4$). Yet inter-continental variance in artistic impression reached ± 2.1 ; European judges prioritised emotional resonance (TF-IDF = 0.087), whereas Asian panels stressed cultural orthodoxy ($r = 0.71$, $p < 0.01$). **Adversary typology** UMAP clustering of 42 kinematic-aesthetic descriptors disclosed three archetypes: radical-innovative (difficulty CV = 27.1 %), stable-control (synchro error = 0.17 m) and balanced-hybrid (technique–art coupling $r = 0.67$). ANOSIM $R = 0.49$, $p = 0.011$, silhouette = 0.58. **Optimised dynamic training** A 4-week intervention ($N = 24$) blending Kuramoto phase-synchronisation (coupling strength $K = 1.34$) with Bayesian risk-decision feedback elevated tactical fidelity by 22.5 % ($p < 0.01$), synchro score by 1.7 points and novel-element success to 82.6 %. However, underwater thrust-variability CV = 15.2 % signals hydrodynamic stability risk. **Neuro-muscular adaptation** Cognitive-motor reaction time shortened by 310 ms ($p < 0.001$); intra-trunk muscle onset asynchrony decreased 28.2 %, confirming central-nervous adaptation to rhythm perturbation training.

Conclusions & Recommendations Under the 5:5 weighting paradigm, victory hinges on a millimeter-level balancing of technical standard insertion and artistic innovation, while mitigating score volatility induced by region-specific referee cognition. **Recommendations** (1) Cultural expression: fuse explicit cultural symbols with implicit

music-spatial coding to amplify cross-cultural legibility. (2) Technique-art synergy: segment routine difficulty gradients and deploy reinforcement-learning recommender to elevate move-theme coupling beyond $r = 0.60$. (3) Referee adaptation: calibrate artistic emphasis profiles against the geographical composition of anticipated judging panels.

Keywords: data-game dual drive; multi-source fusion; dynamic strategy optimization; referee cognitive encoding; Olympic artistic swimming preparation