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Teaching Control System and Comprehensive Evaluation Method for the Development of Coordination Ability of Volleyball Players

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Abstract: Coordination ability is the core element of volleyball skill formation, which directly affects the accuracy, timeliness and economy of technical movements. This paper aims to systematically construct and expound a set of teaching control system and comprehensive evaluation methods suitable for the development of coordination ability of youth volleyball players. This study uses literature data, logical analysis and systematic review to theoretically sort out and define the different types of teaching control (preliminary, operational, current, stage and final control). Further, the paper provides an in-depth analysis of the evaluation paradigm of coordination, covering from high-precision instrumental measurement methods (such as stabilizers, electromyography, and motion capture systems) to practical special motor testing methods (such as the Belyaev test series and the Garbuzov test series). The study points out that an effective training system must be based on systematic and multi-stage teaching control, and the evaluation results must be dynamically fed back to the personalized adjustment of the training plan. Finally, this paper proposes a comprehensive training model that integrates traditional training wisdom and modern technical feedback, aiming to provide theoretical basis and practical guidance for the development of coordination ability of youth volleyball players, and provide a systematic reference framework for training decision-making of grassroots coaches.

Keywords: Volleyball; Coordination Ability; Teaching Control; Motor Assessment

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1.Introduction

One factor in the success of volleyball training is the high level of coordination. It is the coordination of movements that ensures the accuracy, timeliness and economy of technical techniques such as serving, passing, attacking and blocking. In beginner volleyball players, coordination is usually at the stage of active formation, and the effectiveness of its development largely determines the further performance of the athlete during the game.

In recent years, more and more people have paid attention to innovative sports training methods that make the training process more efficient and efficient. Closed-loop technologies (video systems, motion sensors, special simulators, and digital-based applications) open up new opportunities for the development of coordination capabilities. They allow you to quickly obtain incorrect information about technique, body posture, and movement dynamics and correct them in real time. This

purposeful and timely feedback contributes to faster and better motor skill formation among novice athletes [6].

Despite the promise and growing popularity of such methods, the question of how to utilize technical means and provide feedback when working with junior volleyball training teams is still understudied. Until now, the focus has been on sportsmanship at a higher level. At the same time, the early introduction of automatic control and analysis of movements makes it possible to form the correct motor stereotype at the basic stage of training. This not only improves overall training performance but also reduces the risk of reinforcement errors or jeopardizing healthy exercise patterns.

2.Theoretical framework for the control of volleyball players' coordination ability

2.1 Teaching control

Pedagogical controls that assess the development of coordination skills in volleyball players are an important part of the education and training process. Its main goal is to obtain objective data on the training and fitness level of young athletes, so that training methods and physical activity can be adjusted in a timely manner. One of the most commonly used control methods is control competitions and tests, the results of which serve as a reliable basis for management decisions. If the analysis shows no improvement or even deterioration in physical fitness, the coaching staff reviews the training content, adjusts the method and load distribution, and helps adjust the training plan to suit the student's current abilities and needs [4].

The effectiveness of physical education directly depends on the timeliness and regularity of control. The content of the control depends not only on the specific situation of the subject, but also on the teaching tasks set at each training stage. In the context of athlete training management, instructional control can be divided into several types:

1) Initial control. This control is carried out in the initial stages to identify the basic abilities of the student. Its purpose is to assess students' ability to master physical exercise and meet the standards set by the curriculum. Based on the data obtained, the planning of teaching tasks is adjusted, and appropriate methods and means are selected, so that the overall and special physical fitness level of young volleyball players can be accurately judged. Initial control helps to check the performance of movements with a similar structure to the new task and to assess the knowledge, skills and abilities of the athlete after a long training break, which is important for the planning of individual training. It is important to note that the application of this control may be limited for physical exercise that requires long preparation of the body to withstand heavy loads.

2) Combat control. This control focuses on assessing the athlete's body's response during and after training. Here, changes that occur during the exercises are recorded, as well as analyzed based on the flexibility of student feedback, speed of decision-making, and timely correction of tasks. Control allows you to record the intensity of the load within a single movement and throughout the exercise. At the same time, some indicators are recorded before and after training, while others are recorded directly during training, allowing for a comprehensive assessment of the athlete's condition.

3) Current control. Unlike control, current control is carried out continuously for a certain period of time, such as within a week. It is designed to monitor learning and track changes in students' physical condition from class to lesson. This approach helps you identify the dynamics of individual indicators, assess the consequences of the load, and the effectiveness of the recovery process, which is especially important when developing subsequent stages of the training process.

4) Stage and final control. At each stage of the training and at the end of the training cycle, there are full controls so that you can evaluate the results achieved, compare them to the planned metrics, and adjust subsequent training goals. The final control not only summarizes the results, but also makes suggestions for the further development of athletes' coordination ability [3].

2.2 Phased control

Phased control is a set of measures designed to assess changes in the form of young volleyball players after a longer period of training, while developing the best strategy for subsequent macrocycles or independent phases of the training process. During this control, all aspects of training are comprehensively evaluated: from physical fitness to the tactical and psychological characteristics of the athlete. The analysis of the results allows us to identify the deficiencies of the current training system and potential reserves for improvement. Based on the information collected, an individual plan is developed that can cover both a specific training period and an entire macro cycle [12].

Phased control includes the following key actions:

Generalized processing of current control data. In this phase, the results of previous measurements and observations are collected and systematized, allowing you to gain a comprehensive understanding of the overall characteristics and parameters of the teaching process in different stages and training cycles.

Perform final testing and diagnostic procedures. At the end of each phase, special tests and other diagnostic measures are performed to evaluate the cumulative effect of training. These procedures help determine changes in the status of trainees and how their readiness has changed.

Comparative analysis of indicator dynamics. Particular attention is paid to the comparison of the initial phase with subsequent measurements, which helps to assess the rhythm of an athlete's development and identify trends that require adjustments to the training process.

The final control aims to determine the effectiveness of the implementation of the annual plan of the educational process. Its tasks include assessing the resolution of tasks, as well as identifying positive and negative aspects of the physical education process and its components. The final control result becomes the starting point for developing subsequent plans and adjusting the educational process. The main indicators of final control are:

Final academic performance. Assessment of knowledge, skills and competencies acquired during the training process.

Number of athletes. Changes in the number of students required for composition and successful completion.

Sports records and achievements. Results achieved in competitions and internal inspections as indicators of the effectiveness of the training process.

Conclusions and suggestions for improvement. Recommendations based on the final data analysis can help further develop and adapt physical education programs [5]。

Based on the final control results, a decision is made to transfer to the next stage of training if the student meets the established control and transfer criteria. At the same time, health status, test success rate, athletic performance level and other key parameters are also taken into account so that further education systems can be built according to the individual characteristics and abilities of each athlete. The control of fitness levels is also divided into the evaluation of results in the general and special training areas [7]. During the initial training phase, controls are carried out twice a year. In addition, special events such as sports training competitions are scheduled in the competition schedule, which allows you to further assess developments and quickly adjust the training process.

Using instrumental and instrumental approaches, it is possible to objectively and quantitatively assess the coordination ability of young volleyball players and their various components. These methods not only accurately measure metrics but also highlight nuances related to the accuracy, speed, and economy of movements, which are essential for a comprehensive diagnosis of athletes' physical health.

To identify and analyze coordination, a variety of devices are used, each focused on studying specific parameters of motor activity:

Coordinators and tremolometers of varying complexity – coordinators are used to measure the accuracy, speed and economy of movements and thus evaluate the effect of neuromuscular coordination.

Kinemeters, dynamometers, and reflectometers (reactionometers) are designed to evaluate the accuracy of reproduction, differentiation, and measurement of spatial, force, and temporal properties of motion.

Stabilizers are used to measure the ability to maintain balance, which is especially important for volleyball players working in dynamic games.

Photography and filming. Biomechanical techniques such as photography and video recording make it possible to determine the kinematic properties of motion – displacement, velocity and acceleration – and analyze performance techniques in different modes.

EMG helps to study the internal structure of exercise behavior, identify the degree of involvement of various muscles, and evaluate the economics of sports equipment.

Goniometry allows you to accurately measure angular motion and assess the accuracy of joint movement.

Radio telemetry is used to study multiple parameters under the natural conditions of an athlete's movement at the same time,

allowing a comprehensive understanding of their physical condition [14].

It is important to note that despite the accuracy and informational value of instrumental teaching methods, they are often limited by the environmental conditions of the physical education school. In addition, these methods can only measure individual signals of coordination ability, and cannot provide a complete picture of the coordination phenomenon itself.

Figure 1：*Coordination ability assessment tools and functions*

tool	Function description	advantage
Stabilizer	Measure balance ability	Direct feedback on training dynamics
Electromyography	Study muscle engagement	Analyze the internal structure of motor behavior
Motion capture system	Record the dynamic characteristics of the action	Provides high-precision motion technology analysis
Exercise test method	Assess coordination and skill level	Very practical and suitable for junior volleyball players

3.Diagnostic coordination ability

The main method for diagnosing coordination is specially developed motor tests, which allow you to assess both explicit and implicit indicators. There are several stages to follow when creating and using them. First of all, it is necessary to choose a set of tests suitable for assessing the ability to coordinate in all age and gender groups. These tests should cover a wide range of characteristics, from the accuracy and speed of movements, to the ability to differentiate efforts. To ensure the accuracy of the results, it is necessary to develop detailed test methods, taking into account the features of the exercises. Testing as many students as possible allows for the collection of a large database for subsequent analysis. The results are carefully processed to help identify the most reliable and informative indicators of coordination. Based on the analysis, recommendations for use are developed for selected tests in physical education or general education schools. Each test develops criteria to assess the level of development of coordination skills [13]

The selected motor test must have a high degree of scientific validity and meet a number of requirements. The test should be easy to understand and feasible for participants of all ages and gender groups, while providing differentiated results in terms of coordination. In addition, testing does not require long-term special training or complex equipment, making it easy to use on a large scale. Test results should not be significantly distorted by differences in body size, segment length, or weight. The test should cover task performance in both “dominant” and “non-dominant” limbs, enabling the study of lateral and asymmetry of movements, taking into account age and gender [11].

Before the exam begins, it is essential to ensure a high level of motivation and concentration of the participants. They should detail the purpose and procedure of the test, demonstrate the correct performance of the exercises, and provide trial attempts to adapt to the new task. Since test results can be affected by external conditions and interference, it is recommended to try the test multiple times. After each attempt, participants receive accurate feedback that helps maintain motivation and adjust movements for optimal results.

It is recommended to perform a test test at the beginning of the main training phase, immediately after a short warm-up, to avoid the effects of fatigue, which can reduce performance accuracy. It is recommended to repeat the test twice during the school year to track the dynamics of change and to test it separately before and after the passage of specific educational materials to assess their impact on the development of coordination skills. During training, motor tasks that underlie the test can be used in a variable form, but it is essential to avoid translating control tasks into solid motor skills, as this can skew the assessment of the initial level of coordination. To improve the motivation and effectiveness of the test, a competition format is usually used - two or consecutive tasks are completed, which not only objectively evaluates the results, but also stimulates the development of the competitive spirit [10].

4.Evaluate the level of development of coordination ability

4.1 Evaluate the main characteristics of coordination ability

The use of tools and equipment training methods, as well as specially designed exercise tests, allows you to deeply and comprehensively assess the level of coordination of young volleyball players. This integrated approach makes it possible

to identify the strengths and weaknesses of an athlete's athletic fitness, which in turn helps to adjust the training process and adapt it to the individual characteristics of each child. Despite some limitations, especially in sports schools, the use of these methods significantly improves the quality of diagnosis, provides science-based education and training planning, and contributes to high-level physical education performance in the future [15].

In N.M. Kurkina's research, four main characteristics were identified as evaluating the coordination of schoolchildren: correctness of movements, in other words, when the action reaches the desired goal (completion of the necessary action); speed of results; rationality of actions and behaviors (do it when necessary); Motor wit helps a person to find a way out of a difficult dilemma that suddenly arises when performing an action [3]。

These assessments are qualitative and quantitative. The main qualitative characteristics of coordination ability assessment include adequacy, timeliness, initiative, quantitativeness - accuracy, speed, economy and stability of movements. In fact, in addition to these indicators, other indicators are taken into account.

In many cases, the manifestation of coordination is not manifested in isolation, but combined into a complex aimed at achieving the highest athletic performance. Therefore, complex criteria are also widely used when determining coordination capabilities. These criteria include variants of shuttle running, speed, running in a changing direction, mode of movement, overcoming obstacles and ground running, jumping obstacles, accuracy of landing and accuracy in the area, throwing various projectiles from different starting positions to targets and distances (both hands) [9].

4.2 Determine the practice method of coordination ability through the test

Belyaev proposed to determine the level of coordination development of children participating in volleyball through a number of special tests. His approach includes the following exercises:

Test No. 1. The first group includes a series of tasks designed to improve the accuracy and coherence of movements. The student sits on the body mat and passes the ball up. Then he talked about strength – you need to stand up and keep passing while moving forward. The last link is to complete an upper pass through the goal, then pass the ball back, and then pass the up and down passes alternately into the wall.

Test No. 2. The test mainly emphasizes balance, reaction and direction. The athlete needs to stand on the toe of his right foot while bending his left leg, and raise his arms and lift the ball. During the exercise, the ability to quickly reorganize motor activities, spatial navigation, and concentration are recorded.

Test number three. The task of this test is to assess strength, accuracy, and coordination when performing complex movements. First, the athlete serves with maximum force, aiming for the area marked 1, 6 and 5. After that, the upper and lower gears alternate in pairs, while completing a 360-degree turn. Another task is to pass the ball from different starting positions with two people changing partners at the same time, which requires quick adaptation and a high level of coordination.

Test four. This set of exercises is variable and includes a variety of activities: passing, throwing heavy balls, throwing to targets, and relay races for catching and passing. This complex not only demonstrates the level of coordination, but also promotes the development of reaction speed, the ability to orient and quickly change the direction of movement in space [1].

A given test task not only evaluates the overall level of coordination, but also develops qualities such as reaction speed, rapid reaction ability to respond to signals, and lateral vision. Therefore, the development of coordination skills is an important part of the training process for young volleyball players, directly affecting their level of motor skills [8].

In addition to the method of A. Belyaev, S.P. Garbtsov offers a number of test tasks to determine the initial level of coordination of athletes. He recommends the following exercises:

Test No. 1. This is an exercise in which you perform a sprint from a defensive stance, which is common for volleyball players and allows you to assess the speed and accuracy of your reaction.

Test No. 2. A task in which an athlete passes the ball to a certain point to demonstrate his ability to control movements accurately.

Test No. 3. The turnback run combined with the pass allows you to assess the coordination, coherence and dynamics of the movement.

Test No. 4. Exercises to identify dexterity, record the ability to quickly change positions and postures, which are an important part of game skills.

Test No. 5. It is an exercise in hitting or passing a ball to a specific target, helping to assess the accuracy and power of the movement.

These tests not only help identify the initial level of development of coordination skills, but also help to further improve coordination skills. They are an important tool in the training process, as systematic diagnostics allow for timely adjustment of training methods and adaptation of the training process to the individual characteristics of each athlete [2].

Figure 2：Exercises to assess coordination by motor test

Test number	Test Name	Evaluate the content
Test No. 1	Upper passing and return practice	Movement accuracy and coherence
Test No. 2	Balance and reflexes test	Rapid restructuring and concentration
Test number three	Complex action serve test	A combination of strength, accuracy, and coordination
Test No. 4	Passing, throwing and relay races	Evaluate the overall coordination ability and the use of organizational strategies

In short, the development of physical fitness in secondary school children's volleyball, including coordination ability, should be carried out systematically and continuously. Organizing the training process for young athletes requires careful selection of methods that not only ensure safe training, but also make it as efficient as possible. When planning training, the coach must take into account the goals and objectives, the individual characteristics of the student, as well as the material and technical support of the institution. An integrated approach based on step-by-step planning, organization, and control is the key to successfully developing sports skills, developing coordination, and ultimately achieving high volleyball results.

Conclusion

Instructional control over the development of coordination skills in volleyball players is the most important component of the education and training process. The control system includes preliminary, work, current, phase, and final type, allowing you to objectively assess the fitness and dynamics of athlete development. Combining traditional exercise testing with modern instrumental methods helps identify strengths and weaknesses, allowing for timely adjustment of training methods and load distribution. This comprehensive approach provides personalization to the training process and provides a solid foundation for further successful development in young volleyball players.

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The authors declare that there is no conflict of interest regarding the publication of this paper.

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