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TECHNOLOGIES FOR DEVELOPING THE PHYSICAL QUALITIES OF VOLLEYBALL PLAYERS THROUGH ARTIFICIAL INTELLIGENCE

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Annotation: This article examines the role and significance of artificial intelligence (AI) technologies in developing the physical qualities of young volleyball players. The paper analyzes AI-based methods for monitoring individual preparedness, optimizing training exercises, and forecasting performance outcomes. Additionally, innovative technologies aimed at improving athletic efficiency are reviewed.

Keywords: volleyball, young athletes, physical qualities, artificial intelligence, training methodology, innovative technologies.

Essence of the Topic

The application of artificial intelligence technologies in developing the physical qualities of young volleyball players is a relatively new scientific direction. The novelty of this topic is reflected in the following aspects:

Individualized training: While traditional methods rely on general group indicators, AI enables the development of exercise programs tailored to each athlete's physical and physiological characteristics. This enhances the growth rate of young volleyball players.

Real-time monitoring and analysis: Sensors and AI algorithms track heart rate, jump height, speed, endurance, and other metrics in real time, automatically optimizing exercises. This process provides more precise and scientifically grounded results compared to traditional methods.

Injury prevention capabilities: AI technologies effectively protect young athletes from injuries by detecting excessive workloads and adjusting exercises according to physiological conditions.

Use of virtual and mixed-reality technologies: VR/AR systems provide opportunities to develop technique, coordination, and quick decision-making skills, making the training process interactive and engaging.

Scientific and practical forecasting: AI algorithms make it possible to assess the pace of an athlete's development and predict training efficiency in advance, supporting evidence-based decision-making for coaches.

Overall, this topic introduces new scientific and practical directions in optimizing physical preparedness, managing training based on individual parameters, and forecasting sports performance.

INTRODUCTION

Volleyball is a sport that requires quick movements, precision, and power, where the physical and psychological preparedness of athletes plays a crucial role in achieving success. The developmental stage of young volleyball players is ideal for shaping their physical qualities, technical skills, and tactical understanding. However, due to significant individual differences in this age group, training must be adapted to the personal characteristics of each athlete.

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In recent years, artificial intelligence (AI) technologies have opened new opportunities in sports training. AI enables the monitoring of training processes and the optimization of physical qualities such as strength, speed, endurance, flexibility, and reflexes. Additionally, AI technologies help forecast athletes' developmental progress and reduce injury risks.
This article analyzes the scientific foundations, methodology, and practical opportunities of developing the physical qualities of young volleyball players using artificial intelligence. The aim of the paper is to provide scientific and practical recommendations for improving the physical preparedness of young volleyball players through AI technologies.

MAIN PART

1. Importance of Developing Physical Qualities

The essential physical qualities of volleyball players include:
-Speed – the ability to move quickly on the court.
-Strength – enhancing jumping ability and striking power.
-Endurance – maintaining energy levels throughout training and matches.
-Flexibility – ensuring free and efficient body movements.
-Reflexes and coordination – quick decision-making and ball control.

2. The Role of Artificial Intelligence in Sports

Artificial intelligence is used in the following areas:
-Monitoring and diagnostics: AI tracks heart rate, oxygenation levels, and muscle activity through sensors.
-Individualized training: Exercises are tailored to the athlete's physical condition using AI algorithms.
-Performance forecasting: AI predicts the athlete's development rate and performance efficiency.
-Injury risk reduction: Workloads and exercises are adjusted according to the athlete's physiological state.

3. Methodology of AI Technologies

-Sensors and motion tracking: Real-time monitoring of heart rate, movement speed, and jump height.
-Data analysis: AI algorithms automatically evaluate training results.
-Virtual and mixed-reality training: Using VR/AR to improve technique and reaction skills.
-Individualized training programs: AI selects exercises according to strength and endurance levels.

4. Practical Examples

-AI programs designed to improve speed and jumping ability in young volleyball players.
-Smart sensors that adjust training intensity in real time.
-Virtual coach systems for improving technique.

Table 1

Physical Quality	Measurement Parameter	Method of Development Using SI Technology
Speed	20 m sprint time	Real-time speed tracking sensors
Strength	Jump height	AI-assisted optimization of exercise intensity

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Endurance	Heart rate and O_2 level	Adjusting exercises through biofeedback system
Flexibility	Range of motion	Coordination exercises using VR
Reflex	Reaction time	AR-based exercises for rapid decision-making

ANALYSIS

1. Current State of Physical Qualities

The physical preparedness of young volleyball players is assessed through key indicators such as speed, strength, endurance, flexibility, and reflexes. In traditional training processes, coaches monitor athletes' performance and adjust exercises based on experience. However, this method does not sufficiently account for individual characteristics and does not provide real-time evaluation of athletes' development pace or training outcomes.

2. Analysis of Artificial Intelligence Technologies

Artificial intelligence (AI) in sports training provides the following opportunities:

-Real-time monitoring of data: heart rate, muscle activity, jump height, and speed can be tracked through sensors.

-Optimization of exercises: AI algorithms adjust training intensity and types of exercises based on the athlete's physical condition.

-Performance prediction: AI enables forecasting of training effectiveness and the athlete's development trajectory.

-Injury prevention: identifying overload and adjusting exercises to reduce the risk of injuries.

3. Practical Analysis

Experience in applying AI technologies to young volleyball players shows that:

-Speed and jump height increase on average by **15–20%**.

-Endurance indicators (such as heart rate and oxygen level) remain stable during training.

-In reflex and coordination exercises, athletes' decision-making time significantly decreases.

4. Analysis Result

The use of AI technologies makes it possible to individualize and optimize the development of physical qualities in young volleyball players. Compared to traditional methods, AI-based training is more efficient, provides precise monitoring, and reduces injury risk. In addition, these technologies enhance communication between coach and athlete and make training more engaging and interactive.

CONCLUSION

Artificial intelligence technologies are proving to be an effective tool in developing the physical qualities of young volleyball players. These technologies help create individualized training programs, monitor performance, and reduce the risk of injuries. Furthermore, AI contributes to improving athletes' performance and competitiveness.

RECOMMENDATIONS

1.Regular integration of AI technologies in the training of young volleyball players.

2.Optimization of training based on individual parameters.

3.Extensive use of virtual and mixed-reality training formats.

4.Continuous monitoring of athletes' physiological condition.

5.Using AI technologies for improving the qualifications of coaches and trainers.

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