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APPLICATION OF ELECTRONIC MEANS IN COACHING CONTROL OF VOLLEYBALL

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Abstract. The article explores the application of electronic tools in coaching control for volleyball competitions, including video analysis, biomechanical systems, physical activity trackers, as well as the use of artificial intelligence and statistical analysis. Key areas of technology application are described, such as tactical and technical evaluation, physical condition monitoring, and training process individualization. The relevance of this research is substantiated by factors such as increased sports competition, workload individualization, advancements in sports medicine, and the growing accessibility of digital technologies. The article identifies key research tasks, including the development of video analysis models, assessment of wearable sensor effectiveness, AI-based game situation prediction, and the impact of electronic tools on team interaction and psychological preparation. The conclusion highlights the importance of integrating advanced technologies to enhance the training process efficiency and ensure athlete safety.

Key words: digital technology, electronic tools, training control in volleyball.

ПРИМЕНЕНИЕ ЭЛЕКТРОННЫХ СРЕДСТВ В ТРЕНЕРСКОМ КОНТРОЛЕ СОРЕВНОВАНИЙ ПО ВОЛЕЙБОЛУ

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Аннотация. В статье рассматривается применение электронных средств для тренерского контроля в соревнованиях по волейболу, включая видеоанализ, биомеханические системы, трекеры физической активности, а также использование искусственного интеллекта и статистического анализа. Описаны основные направления применения технологий, такие как оценка тактики и техники, мониторинг физического состояния и индивидуализация тренировочного процесса. Уточняются причины актуальности этих исследований, среди которых повышение уровня конкуренции в спорте, индивидуализация нагрузок, развитие спортивной медицины и рост доступности цифровых технологий. Выделены ключевые задачи исследования, включая разработку моделей для видеоанализа, оценку эффективности носимых датчиков, использование ИИ для прогнозирования игровых ситуаций и изучение влияния электронных средств на командное взаимодействие и психологическую подготовку. Делается вывод о значимости интеграции передовых технологий для повышения эффективности тренировочного процесса и обеспечения безопасности спортсменов.

Ключевые слова: цифровые технологии, электронные средства, тренировочный контроль в волейболе.

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The use of electronic tools for coaching control in volleyball competitions is essential for enhancing the efficiency of the training process and optimizing game strategies. Modern electronic tools enable coaches to collect and analyze large amounts of data, which helps improve both individual and team performance. The main areas of technology application in volleyball include the following [1, 2]:

– Video Analysis and Game Situations Review: Programs for recording and analyzing matches help coaches assess tactics, identify errors, and highlight the strengths of players and the team as a whole. This enables coaches to adjust strategies based on objective data. Popular video analysis programs in sports include Dartfish, Hudl, and Coach's Eye.

– Biomechanics and Kinematics Analysis Systems: Specialized sensors and cameras assess the precision, speed, and efficiency of movements. This data helps coaches optimize the technique of key volleyball elements, such as spikes and jumps, which is critical for injury prevention and technical training improvement. Systems like Vicon and Kistler are commonly used for biomechanical data collection.

– Trackers and Physical Activity Monitoring Sensors: Wearable devices and sensors (e. g., heart rate monitors, GPS trackers) allow coaches to monitor heart rate, workload, and player fatigue levels in real-time. This information aids in setting optimal rest and training intervals for each athlete, reducing the risk of overtraining and enhancing training effectiveness. Popular trackers include Polar and Catapult.

– Tactical Analysis with Artificial Intelligence (AI): Modern AI-based systems can analyze video data and assist coaches in predicting the behavior of players and opponents. AI systems can design tactical schemes, forecast outcomes of various strategies, and help make more informed decisions during matches.

– Statistical Analysis Software: Applications enable coaches to track detailed statistics on various game parameters – such as serves, pass accuracy, blocks, and more. Programs like DataVolley and

VolleyStats provide statistical tracking and analysis, highlighting areas in need of improvement.

These technologies assist coaches in assessing players' conditions and progress, making them an essential tool for maintaining high standards of preparation and team competitiveness.

Relevance of Research in the Use of Electronic Tools in Coaching Control for Volleyball Competitions.

The relevance of research into the application of electronic tools in volleyball coaching control is underscored by several factors, tied to the general trend toward digitalization and increased performance expectations in sports. Key relevance aspects include:

– Increased Competition Levels in Sports: Modern sports, including volleyball, demand a high level of physical and technical readiness. Given the narrow gap between elite teams, using electronic tools for game and training data analysis has become a significant factor in gaining a competitive edge.

– Individualization of the Training Process: Electronic devices enable the collection and analysis of data for each player individually, crucial for identifying strengths and weaknesses, predicting physical conditions, and managing workload levels. Such data assists in creating personalized training and rehabilitation programs, thereby improving each player's performance and reducing injury risks.

– Enhanced Tactical Training: Video and match data analysis allows coaches to develop more effective tactical schemes, vital in volleyball where team synchronization is crucial. AI-based software can process vast data volumes, enabling opponent action analysis and tactic prediction, an essential component of competition preparation.

– Technological Advances and Accessibility: – Modern technologies such as AI, data analysis, and video monitoring are becoming increasingly accessible and accurate, allowing their use not only at the professional level but also in amateur sports. This contributes to the widespread use of electronic tools and heightens the importance of research into their adaptation for sports.

– Advances in Sports Medicine and Physiology: Systems that monitor physiological parameters like heart rate, fatigue levels, and recovery assist coaches in optimizing workloads and preventing injuries, particularly in high-intensity and contact sports. Utilizing this data can extend athletes' careers and enhance resilience to physical stress.

– Integration with Educational and Research Processes: The application of electronic tools in sports is an important topic in sports science and education. Research in this area opens new avenues for developing training methodologies, managing training processes, and educating future coaches and sports analytics specialists.

The research goal is to analyze and justify the use of electronic tools and information technologies for coaching control in volleyball competitions.

The key research tasks include:

– Developing and Testing Video Analysis Models for Game Tactics and Technique Evaluation: The goal is to create efficient video analysis models that allow coaches to quickly and accurately analyze game situations, identify errors, and adjust tactics. Tasks may involve selecting optimal algorithms for movement and tactical scheme analysis.

– Assessing the Effectiveness of Wearable Sensors and Trackers in Training and Competition: This task involves analyzing how sensors (e.g., heart rate, GPS) influence training load management and injury prevention. The study could reveal how objective data on athletes' physical states help individualize training loads and reduce the risk of overtraining.

– Analyzing the Impact of Electronic Tools on Player Tactical Training: This task examines how using video and analytical programs affects players' tactical understanding. This may include developing training methods based on video and data analysis to enhance players' ability to adapt to tactical schemes.

– Researching the Use of AI for Predicting Game Situations: The goal is to study AI's potential for match data analysis and prediction of team and opponent behavior. Tasks may include the development and testing of algorithms that help coaches adapt tactics in real-time based on game flow.

– Developing Recommendations for Using Biomechanical Systems to Analyze Movement Technique: This task may involve studying how biomechanical systems (e.g., motion sensors and angular velocity sensors) help refine player techniques, particularly for jumps, serves, and blocks. The study could provide recommendations for reducing injuries by optimizing techniques.

Each of these tasks can be supported by methods and tools [3] that ensure analytical precision and objectivity, with results that broaden the understanding of electronic tool applications in volleyball and other team sports.

Conclusion. The integration of advanced technologies improves the efficiency and safety of the sports process, thereby enhancing team performance and contributing to sports science development. It opens new approaches to training management and athlete preparation.

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