The application of digital technologies in athletes' training processes and their impact on preparation effectiveness

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Abstract

This scientific work examines the specifics of using digital technologies in the training process of athletes. The relevance of the research is determined by the need to increase training effectiveness through the implementation of modern digital analysis and monitoring tools. As part of the study, a 25-question survey was developed and conducted to determine the extent of digital technology use, its impact on training activities, and the level of analytical and individualized approaches in athlete preparation. The article presents the analysis results of 5 key questions that reflect the most important aspects of using digital technologies: their frequency of use, application in analyzing movement technique, use of statistical indicators, individualization of the training process, and impact on the development of self-monitoring in athletes. The results obtained indicate that digital technologies are gradually becoming an integral part of the training process, yet for a majority of respondents, their application has not yet become systematic. It was found that digital tools are more commonly used for episodic analysis and partial individualization, while regular, comprehensive use is observed in a smaller proportion of athletes.

Keywords: digital technologies, training process, athletes, technique analysis, individualization of training, self-monitoring, sports statistics, questionnaire.

Introduction

The modern stage of sports development is characterized by the active integration of digital technologies into the training process. The rapid advancement of information and communication technologies creates opportunities for the widespread application of innovative approaches in the sports field, serving to organize the training process on a scientific basis, monitor the functional state of athletes, and enhance the effectiveness of their preparation. Today, mobile applications, video analysis systems, GPS trackers, wearable heart rate monitors, biomechanical analysis software, and platforms based on elements of artificial intelligence are widely used in athlete training.

Digital technologies make it possible to obtain precise and objective data on athletes' physical loads, technical-tactical actions, speed, endurance, coordination, and recovery processes. This allows coaches to plan training loads according to the individual capabilities and functional state of each athlete. The individualization of the training process is a particularly important factor in achieving high athletic results. From this perspective, digital tools help optimize training sessions by taking into account the individual characteristics of athletes.

Furthermore, video analysis systems significantly enhance the effectiveness of studying athletes' technical movements in detail, identifying errors, and correcting them. For example, in sports like basketball, football, and volleyball, the biomechanical properties of movements are studied in-depth by analyzing technical elements in slow motion. As a result, athletes have a greater opportunity to perfect their technical skills.

Additionally, wearable sensor devices enable the real-time monitoring of athletes' functional indicators. The regular monitoring of metrics such as heart rate, energy expenditure, distance covered, sleep quality, and recovery rate helps to reduce the risk of overexertion and injury. Concurrently, feedback technologies play a crucial role in fostering self-control, motivation, and a conscious approach to training among athletes.

However, despite the wide-ranging potential of digital technologies in sports, the effective integration of these tools into the training process has not been sufficiently studied. In some cases, the low technological literacy of coaches, the high cost of equipment, and the lack of methodological recommendations hinder the effective use of digital tools. Therefore, developing a scientific and methodological basis for applying digital technologies in the sports training process is a pressing issue.

Based on the foregoing, the purpose of this research is to study the specific ways digital technologies are used in athletes' training activities, to determine their impact on training effectiveness, and to develop scientific and practical recommendations for improving the training process based on modern technologies.

Methods

The study employed theoretical analysis of scientific and methodological literature, a questionnaire, and methods of mathematical statistics. The questionnaire was administered to athletes (n = 30). The developed questionnaire consisted of 25 questions aimed at studying the level of digital technology use in the training process, the specifics of its application, and its impact on various components of preparation. Within the scope of this article, five key questions were analyzed, reflecting: the frequency of digital technology use; its application in analyzing movement technique; the use of statistical indicators; the individualization of the training process; and the impact of digital technologies on athletes' self-monitoring. The results were processed based on a percentage analysis.

To study the characteristics of digital technology use by athletes in the training process and to determine its impact on the effectiveness of athlete preparation, technical-tactical performance, and functional state.

Research Objectives:

To analyze the theoretical and practical foundations of modern digital technologies used in the sports training process.

To determine the extent to which athletes use mobile applications, video analysis systems, and wearable devices during their training process.

Studying the status of digital technology use, attitudes towards them, and practical challenges by conducting a questionnaire survey among athletes and coaches.

Identifying opportunities to monitor and individualize training loads with the help of digital technologies.

Evaluating the effectiveness of monitoring athletes' technical movements and functional indicators using digital tools.

Analyzing the importance of feedback technologies in developing self-monitoring, motivation, and training discipline in athletes.

Empirically assessing the impact of using digital technologies on the effectiveness of athlete preparation.

Developing scientific and practical recommendations for the effective use of digital technologies in the training process.

Results and discussion

During the organization of this study, a questionnaire survey was used to determine the extent to which athletes use digital technologies in their training activities. The research findings revealed that although digital technologies are increasingly being used in modern sports training, their practical implementation is not yet sufficiently systematic. While a certain portion of respondents reported regular use of mobile applications, video analysis tools, and statistical software, it was found that for the majority of athletes, the use of these tools is episodic. This indicates that the potential of digital technologies is not being fully utilized.

Based on the survey results, it was determined that using video analysis tools to analyze movement technique allows athletes to identify technical errors and correct them promptly. In particular, slow-motion video recordings and methods for comparing technical movements proved to be effective tools for improving the technical preparation of athletes. However, the majority of respondents noted that they use such technologies only in certain training sessions. This signifies that the process of technical analysis has not been established on a regular basis.

The results from the analysis of statistical indicators of game performance also revealed a similar situation. Although some respondents use statistical data consistently, for most athletes, this type of analysis is only performed in specific cases. Regular monitoring of statistical indicators allows for an objective assessment of athletes' game effectiveness, the identification of tactical shortcomings, and the optimization of training loads. Therefore, it is crucial to make statistical analysis an integral part of the training process.

The issue of training individualization was also separately examined during the study. The results showed that digital technologies serve as an effective tool for considering the individual capabilities, functional condition, and physical fitness level of athletes. However, the majority of respondents indicated that the process of individualization is not yet fully established. This situation can be explained by the lack of technical resources in some sports organizations or the insufficient methodological training of coaches for working with digital technologies.

Additionally, the research findings confirmed that digital technologies have a positive impact on the development of self-monitoring skills in athletes. A majority of respondents not-

ed that digital tools increased their ability to track their physical condition, analyze training outcomes, and manage their workloads. This is a key factor in fostering a more conscious and responsible approach to training among athletes.

Overall, the research results indicated that using digital technologies in the sports training system yields effective results. At the same time, the study identified a need for their broader integration into the training process, the systematization of their use, and the development of digital competencies for both coaches and athletes. This is crucial for improving the quality of athlete preparation, organizing training on a scientific basis, and achieving high sports performance.

Question 1. How often are digital technologies used in your training activities?

The research findings indicated varying levels of digital technology usage in athletes' training activities. Twelve athletes, representing 40.0% of respondents, reported using digital tools regularly. For this group, mobile applications, heart rate monitors, video analysis systems, and various digital platforms have become an integral part of their training process. These tools enable the systematic monitoring of training loads, the quality of technical execution, and the athlete's functional condition.

Eleven athletes, constituting 36.7% of respondents, noted that they sometimes use digital technologies. While this suggests the availability of technical resources at sports institutions, it also implies that their use has not yet become consistent or systematic. Additionally, 16.7% (5 respondents) stated that they rarely use digital tools, employing them mainly in specific situations where evaluating certain performance indicators is necessary.

Only 6.6% (2 athletes) indicated that they do not use digital technologies at all in their training activities. This may be explained by a lack of technical equipment, the low digital competence of coaches, or a preference for traditional training methods. Overall, the results show that a trend of using digital technologies in sports preparation is emerging, but this process has not yet been fully systematized.

Question 2. Are digital tools used to analyze movement technique?

The results from the analysis of movement technique confirmed that digital tools play a significant role in the technical preparation of athletes. Eleven athletes, representing 36.7% of respondents, noted their regular use of video recordings, slow-motion playback, and software that allows for the comparison of technical movements. Such technologies enable the precise identification of athletes' technical errors, an in-depth analysis of movement biomechanics, and the improvement of technical mastery.

The largest group, 40.0% of respondents (12 individuals), indicated that they use digital technical analysis tools only in certain situations. This suggests that although video analysis capabilities are available, they are not yet regularly applied in all training sessions. Additionally, 16.7% (5 athletes) noted that they rarely use technical analysis tools. In such cases, the opportunities for rapid detection and correction of technical errors are limited.

Only 6.6% of respondents (2 individuals) stated that they do not use digital tools at all when analyzing technical movements. These results indicate the need to further improve technical analysis and more widely implement video technologies in sports training.

Question 3. Are game statistical indicators analyzed?

The results regarding the analysis of statistical indicators of game activity showed that an analytical approach is gradually forming in athlete preparation. Ten athletes, representing 33.3% of respondents, stated that they regularly analyze statistical data. This signifies a desire to use objective indicators in the training process and to evaluate sports results on a scientific basis.

The largest group of respondents—40.0% (12 individuals) —noted that they sometimes use statistical analysis. This indicates that while statistical data are utilized in training activities, they have not yet become the primary tool for managing preparation. At the same time, 20.0% (6 athletes) reported that they rarely perform statistical analysis, which is explained by its use primarily during the competition period.

Only 6.7% (2 individuals) of respondents noted that they do not use statistical data in their training process. The results obtained show that the systematic integration of statistical analysis into training activities can be an important factor in enhancing the technical and tactical preparedness of athletes.

Question 4: Are digital technologies used to individualize training?

The results regarding the individualization of training showed that digital technologies are an important tool for considering the indi-

vidual characteristics of athletes. 10 athletes, representing 33.3% of respondents, stated that the selection of workload and training parameters based on digital data is carried out on a consistent basis. This allows for the consideration of the athletes' functional state, physical fitness, and recovery level.

Twelve athletes, representing 40.0% of respondents, noted that elements of individualization are applied only in certain cases. While this indicates the presence of an individualized approach, it suggests that it is not yet fully developed. Additionally, 20.0% (6 respondents) stated that the individualization of training is rarely implemented.

Only 6.7% (2 athletes) noted that an individualized approach based on digital technologies is not used in their training. Overall, the results show that while digital tools have high potential for individualizing training, their application requires further systematization.

Question 5: Does the use of digital technologies improve an athlete's self-monitoring?

The survey results confirmed that digital technologies have a positive impact on the development of self-monitoring skills in athletes. 14 athletes, making up 46.7% of respondents, emphasized that digital tools allow them to regularly track their physical condition, workload, and training outcomes, and also help improve discipline.

Furthermore, 33.3% (10 respondents) reported that digital technologies have a partially positive effect. In their view, the effectiveness of self-monitoring depends not only on technological tools but also on the athlete's personal responsibility and motivation.

While 4 athletes, representing 13.3% of respondents, noted that the impact of digital tools was weak, only 6.7% (2 respondents) stated that there is no connection between such technologies and self-control. Overall, the results showed that digital technologies play a significant role in developing athletes' self-control, discipline, and a conscious approach to their training process.

Conclusion

The research findings indicate that the integration of digital technologies into athletes' training activities is a gradual process. Although a certain portion of respondents regularly use mobile applications, video analysis systems, statistical software, and wearable devices, it was found that in most cases, these tools are used sporadically. While this confirms that digital technologies have been introduced into sports training, it also reveals a lack of systematic and consistent application.

The results from the movement technique analysis demonstrated that video analysis tools are effective for identifying and correcting athletes' technical errors. At the same time, the irregularity of technical analysis limits opportunities to further enhance the quality of technical preparation. This underscores the necessity of consistently applying video analysis technologies throughout the training process.

The analysis of game statistics indicates a growing trend towards an analytical approach in sports. However, because statistical data is mostly used during specific training sessions or competitive periods, it has not yet become a primary tool for managing training. It was determined that the systematic application of statistical analysis serves to increase the effectiveness of athletes' technical and tactical preparation.

The findings on the individualization of training showed that digital technologies make it possible to account for athletes' individual characteristics, functional condition, and workload levels. At the same time, it was observed that the individual approach has not been developed to the same extent for all athletes. This is explained by the lack of technical equipment, methodological support, and digital competencies in some sports organizations.

The study also found that digital technologies have a positive impact on the development of athletes' self-monitoring skills. The majority of respondents noted that digital tools have enhanced their ability to track training loads, physical condition, and results. This, in turn, helps strengthen athletes' sense of responsibility, discipline, and conscious approach to their training.

Overall, the research findings confirmed that using digital technologies in the sports training system is a crucial factor in enhancing training effectiveness. Therefore, it is advisable to expand the use of digital tools in training activities, introduce them systematically, improve the digital literacy of coaches and athletes, and develop methodological recommendations based on modern technologies.

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