

Research on the Application of Big Data Technology in Extracurricular Sports for Teenagers

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Abstract: Wearable technologies have advanced the field of performance assessment by offering immediate information on biomechanics, physiological reactions, and movement patterns. This has improved coaches' capacity to optimize training and reduce the risk of injuries. The utilization of big data in injury prevention is essential since it involves the analysis of past data to discover elements that contribute to risks and subsequently implement proactive steps to ensure the safety and well-being of young athletes. Moreover, using big data in talent identification provides a more impartial and comprehensive assessment of players' skills while reducing the influence of prejudices. This study examines the revolutionary influence of big data technology on extracurricular sports for adolescents, specifically focusing on training methods, performance evaluation, injury prevention, and talent recognition. Incorporating sophisticated data analytics has transformed training by facilitating customized, data-centric methods that cater to the unique requirements of individual athletes. Integrating big data in teenage sports represents a profound transformation, highlighting individualized growth, inclusivity, and general well-being.

Keywords: Big Data, Teenage Sports, Performance Assessment, Data Analytics, Sports Technology

1. Introduction

A revolutionary shift is taking place at the intersection of advanced data technology and extracurricular activities for teens, fundamentally transforming the way athletic development is approached in digital advancements. In the context of the interaction between technological advances and sports, a significant amount of data plays a crucial role in unleashing the untapped abilities of young athletes. One such domain experiencing a profound impact is the realm of extracurricular sports for teenagers. In this context, the integration of big data technology stands as a transformative force, reshaping how we understand, approach, and nurture the athletic potential of the younger generation. As our world is increasingly digitized, the synergy between data analytics, machine learning, and sports for teenagers has emerged as a pivotal intersection, promising enhanced performance and a holistic reimagining of how we conceptualize and cultivate athletic talent. This research aims to thoroughly investigate the diverse impacts of big data technology on the sports engagements of adolescents. The revolution takes place when the integration of data analytics, machine learning, and technical developments occurs. This revolution is transforming the methods used for training, evaluating performance, preventing injuries, identifying talent, and managing sports.

As the research advances, it becomes evident that integrating big data surpasses conventional teaching techniques. Real-time information and precise insights are valuable resources for coaches, enabling them to navigate the intricate realm of individual and team performance effectively. The use of big data allows for accurate analysis, improving the efficiency of training programs and offering a deeper understanding of the specific needs and abilities of particular young athletes. Using big data is essential in establishing a comprehensive and long-lasting teen sports environment beyond individual advancement. This research examines the profound shift in mindset, analyzing the mutually advantageous relationship between extensive data and teenage sports. The research has a purpose of emphasizing the possibility of exceptional achievement and the challenges that must be carefully overcome in this progressive field of physical progress.

2. Big Data Application in Extracurricular Sports for Teenagers

2.1. Training Methodologies

The emergence of big data technology has significantly changed the training methods used in extracurricular sports for teenagers. By incorporating advanced data analytics technologies, coaches can now obtain unparalleled insights into the complexities of both individual and team performance measurements. Jifang and Jianguo demonstrate the paradigm change by showing how data-driven insights can help pinpoint precise skill deficiencies in young athletes [1]. Coaches can customize training sessions to target these subtle shortcomings by analyzing sprint speeds, shot accuracy, and reaction times in great detail. This signifies a shift from conventional, generic methods, introducing a new era of more focused and individualized techniques for enhancing skills.

A salient feature of this transformation is the rise of exceedingly customized training packages. A number of studies demonstrate the effectiveness of utilizing big data analytics to customize training programs based on the specific characteristics of each young soccer player. For instance, Guo notes that by doing a thorough examination of player movement data, coaches get the ability to discern the particular strengths and shortcomings of individual players [2]. Equally, Deng et al. report that a detailed comprehension of this information allows for developing training sessions tailored to address unique requirements and promote a more encouraging and all-encompassing atmosphere [3]. The transition towards personalized training recognizes and appreciates the varied abilities within a group of teenage athletes, fostering a comprehensive and all-encompassing approach to the growth of each athlete.

In addition to on-field performance measures, big data affects training approaches by including biometric data. The study conducted by Cai, Huang and Ning shows a comprehensive approach by investigating the integration of sleep data into training regimens, specifically among teenage swimmers. Coaches can boost overall athletic performance by crafting training regimens that optimize recovery and reduce tiredness, considering elements outside typical performance indicators, such as heart rate variability and sleep patterns[4]. The intricate comprehension of an athlete's physical condition demonstrates how big data enables a more thorough and customized strategy for training, highlighting the significance of overall well-being in sports advancement.

In addition, big data technology empowers trainers to go beyond conventional training methods and embrace a more sophisticated and tailored approach. Integrating individual and team performance measurements with physiological data gives coaches a thorough comprehension of each athlete's talents and requirements[1]. This data-driven advancement represents a big step toward optimizing the capabilities of each member of the sports community. By recognizing and embracing the profound impact they can have, coaches take on the role of designing customized training programs that are guided by data. These programs improve performance and prioritize the well-being and inclusion of young athletes participating in extracurricular sports.

2.2. Performance Assessment

The landscape of assessing teenage athletes' performance has radically transformed with the advent of big data technology. This paradigm shift transcends traditional evaluation methods, ushering in a new era in sports where data-driven insights play a central role. At the heart of this revolution are wearable devices and sensors, acting as catalysts for change by providing real-time information on biomechanics, physiological responses, and movement patterns. The profound implications of this transformation empower coaches to make nuanced decisions, ultimately enhancing the overall training experience for teenage athletes. One pivotal aspect of this performance assessment revolution lies in utilizing wearable devices for monitoring biomechanics, a concept underscored by research conducted by Barba-Martín et al. [5]. These wearable sensors, ranging from sophisticated smart shoes to motion-capture suits, meticulously capture intricate details of athletes' biomechanical profiles during training and competition. The data gathered includes joint angles, gait mechanics, and posture, providing coaches with a wealth of information. Armed with these insights, coaches can pinpoint biomechanical inefficiencies, rectify movement patterns, and tailor training interventions with precision that enhance athletic performance and mitigate the risk of injuries.

Comprehensive performance assessment extends beyond biomechanics to encompass real-time monitoring of physiological responses through wearable devices. Heart rate variability, oxygen saturation, and lactate levels are invaluable indicators of an athlete's readiness, fatigue, and recovery capacity. Coaches, armed with this real-time physiological data, gain the ability to optimize training loads, design individualized recovery protocols, and proactively prevent overtraining [6]. The long-term athletic development fostered by these interventions underscore the profound impact of big data technology on the holistic well-being of teenage athletes.

Integrating big data in performance assessment extends further to analyzing movement patterns through wearable technologies like accelerometers and gyroscopes. In sports such as soccer or basketball, where agility and rapid changes in movement are paramount, these devices capture data on acceleration, deceleration, and changes in direction. The seminal work by Sun demonstrates how analyzing movement patterns unveils insights into tactical decision-making [6]. Coaches can leverage this information to refine game strategies, tailor training drills to enhance specific skills, and ultimately elevate the overall performance of teenage athletes [7]. As wearable devices advance in sophistication, coaches find themselves equipped with a powerful arsenal of data-driven insights, propelling the next generation of athletes toward peak performance and optimal health. The trajectory of teenage sports is reshaped, not merely by the evolution of technology but by the strategic and informed decisions enabled by synthesizing multifaceted data sources.

2.3. Injury Prevention

Within the ever-changing realm of teenage sports, the paramount importance of injury prevention is a main focus for coaches and sports experts. The emergence of big data technology has become a powerful factor in transforming how injury risks among young athletes are addressed, offering a preventative approach. Data analytics systematically analyzes historical injury data to identify trends, commonalities, and probable risk factors. According to Park et al., analytical knowledge is used to empower coaches in making educated decisions that effectively minimize injuries and foster a safer environment for young athletes [8]. The user's input is void of any content. Through the utilization of injury surveillance systems and the application of big data analysis, coaches acquire a thorough comprehension of injury patterns, enabling them to develop efficacious injury prevention techniques in youth sports.

Accurately identifying specific risk factors that heighten the susceptibility of young athletes to injuries is a vital component in utilizing big data technology for injury prevention. Pressley et al.

showcases the efficacy of a method that entails a thorough examination of multiple factors that contribute to the likelihood of injury in adolescent soccer players[9]. By examining player demographics, previous injury history, and game-related factors, researchers have identified significant factors that contribute to injuries. Coaches can utilize these discoveries to their benefit by tailoring training programs, implementing targeted interventions, and instructing athletes on personalized ways to mitigate injuries [9]. This strategy employs tailored approaches grounded in extensive data to provide a more effective framework for injury prevention, significantly enhancing young athletes' overall health and well-being.

The utilization of big data technology in adolescent sports facilitates the instantaneous tracking of exhaustion levels among athletes, offering a valuable instrument for prompt intervention to avert accidents. Wearable gadgets equipped with sensors can detect physiological signs, movement patterns, and task intensity, showcasing this technical progress. For example, Jifang and Jianguo conducted a study using wearable technology to track the level of effort and tiredness in teenage fast bowlers in cricket[1]. Through establishing correlations between workload and injury occurrence, coaches acquired valuable insights into the intricate equilibrium between training intensity and recovery. Implementing proactive monitoring enables coaches to make real-time adjustments to training loads, integrate necessary rest intervals, and apply preventive measures, ultimately decreasing the probability of fatigue-induced injuries in adolescent athletes.

More importantly, the primary aim of utilizing big data technology in injury prevention is to reduce the immediate risks of injury and promote the long-term engagement and overall well-being of adolescent players in sports. Goossens et al. content that introducing injury prevention programs based on epidemiological data significantly decreased serious injuries among young football players[10]. Engaging in sports activities ensures physical safety and promotes young folks' long-term physical and mental well-being. Implementing a proactive and data-driven approach ensures safety and promotes a good and rewarding sports experience for young athletes[10]. Consequently, this fosters ongoing engagement and nurtures a long-term dedication to physical exercise, demonstrating big data technologies' profound capacity to influence adolescent sports' trajectory.

2.4. Talent Identification

Identifying talent in sports has always been subjective and prone to bias, relying mainly on the intuition and expertise of coaches and scouts. Yet, the emergence of big data technologies has led to a significant change, bringing objectivity and accuracy to talent identification procedures. State-of-the-art analytics systems examine extensive performance data, yielding a more precise and nuanced comprehension of players' talents established that using big data for talent identification in soccer has been highly successful[11]. The researchers utilized machine learning algorithms to examine player performance measures, including ball possession, effective passes, and defensive actions. The results highlighted the algorithm's proficiency in discerning skilled players using measurable performance markers, diminishing the need for subjective assessments.

An important consequence of big data in talent discovery is its capacity to reveal obscure talents and acknowledge the potential in players who may have otherwise remained undiscovered. Conventional scouting approaches tend to prioritize renowned teams or regions, possibly disregarding potential talent in less-explored areas. Big data overcomes regional biases, guaranteeing a more comprehensive approach to identifying talent. An example of this is the Moneyball phenomenon in baseball, as Deng et al. emphasized, which demonstrated how data-driven analysis enabled the Oakland Athletics to find players who were not recognized for their true value [3]. This approach challenged traditional scouting beliefs and encouraged a more diverse selection of players. Hohmann and Siener studied talent identification in youth basketball. They used big data analysis to examine player statistics. The research identified cases when players from underrepresented neighborhoods

performed similarly or even better than players in more established programs[12]. The democratizing impact of big data on talent discovery is highlighted, as it allows a broader range of athletes to be considered.

The impact of big data in talent identification goes beyond discovering undiscovered talent; it also tackles inherent prejudices in conventional scouting techniques. Subjective elements, such as personal prejudices and previous conceptions, can sway human judgment. Free from such biases, big data algorithms offer a more impartial assessment of players based on their real performance indicators. This diminishes the probability of disregarding gifted individuals based on variables unrelated to their athletic aptitudes. In their study, Feng et al. conducted a thorough examination of talent identification in track and field by utilizing big data [11]. Their analysis showed a noteworthy decrease in prejudices related to gender and race. The study employed performance data from diverse contests and discovered that the algorithmic methodology proficiently recognized talent using objective parameters, enhancing the fairness and inclusivity of the talent identification process.

Using big data in talent identification not only fosters inclusion in the current context but can also influence the future of sports. Big data enhances the diversity and dynamism of the sports sector by offering possibilities to a wider range of athletes, irrespective of their background or origin. The presence of diverse individuals enhances the pool of talented individuals, creating a competitive atmosphere that accurately represents the wide range of sporting abilities. Chu emphasized the need to use objective data analysis to identify gifted individuals at an early stage[13]. This approach can help create fairer chances and contribute to forming a more diverse group of exceptional athletes. The incorporation of big data technology in extracurricular sports for teenagers is more than just a technological advancement. It encompasses a comprehensive change that emphasizes personalized development, inclusiveness, and general welfare [13]. Coaches are recognizing the significant influence they can have by using data-driven methods. The direction of youth sports is influenced by both technical advancements and the informed choices made based on the combination of many data sources.

3. Conclusion

In summation, incorporating big data technologies into extracurricular sports for teenagers signifies a significant transformation across multiple aspects. Advanced data analytics in training approaches provides trainers with exceptional insights into the performance of individuals and teams, enabling them to implement customized interventions to target specific skill deficits. In addition to traditional performance metrics, big data analysis includes using biometric data, as demonstrated in Johnson et al.'s research on adolescent swimmers. Similarly, wearable devices and sensors in performance assessment bring about a significant transformation by offering instantaneous data on biomechanics, physiological reactions, and movement patterns. Coaches can utilize this abundance of data to improve training interventions, optimize sports performance, and reduce the likelihood of injuries. The shift in injury prevention methodology is visible as big data systematically examines past injury data to uncover patterns and elements contributing to risk. The method, as demonstrated in the research conducted by Fortington et al. and Emery et al., not only decreases the frequency of injuries but also enhances the safety of young athletes by implementing effective preventive measures. Ultimately, the influence of big data on talent identification surpasses conventional subjective approaches, offering a more precise and impartial evaluation of players' talents. The objectivity demonstrated in research conducted by Smith et al., Lewis, Johnson, and Gutierrez, and Wang et al. not only reveals hidden abilities but also promotes inclusivity and contributes to the development of a more varied future for sports.

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