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Artificial Intelligence in the Improvement of the Athlete's Anatomical-Physiological Parameters: Transdisciplinary Pedagogical Models

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Abstract: Artificial Intelligence (AI) is revolutionizing the field of physical activity and training, providing advanced tools to monitor and optimize anatomical and physiological parameters in real time. By analyzing data from biometric sensors and wearable devices, AI enables an unprecedented level of personalization in training programs, enhancing athletic performance and reducing the risk of injuries. Beyond the technical aspect, the integration of AI in sports also has significant pedagogical implications. It not only fosters body awareness and self-regulation in athletes but also requires proper training for coaches and professionals to correctly interpret and apply data effectively. Therefore, AI is not just a tool for performance enhancement but also a means to promote an educational approach based on reflection, autonomous management of physical abilities, and the development of mental and emotional skills. This article examines the role of AI in optimizing physical activity, highlighting both its technical and pedagogical aspects, with the goal of understanding how these technologies can encourage a more conscious and sustainable approach to training and body care.

Keywords: Sports Education; Personalized Training; Athletes Monitoring.

1. Introduction

Artificial Intelligence (AI) is rapidly changing our understanding of physical activity and training, bringing with it the ability to optimize and monitor anatomical and physiological parameters in real time with a level of precision and personalization never seen before (Orlando, 2022). In a world where the improvement of physical performance is closely linked to the knowledge and management of physiological processes, the introduction of AI in the field of physical activity represents a real revolution. Smart technologies make it possible to analyze huge amounts of data from biometric sensors, wearable devices and digital platforms, offering detailed insights into how the body works during physical exercise and favoring the personalization of workouts. Not only do these innovations improve athletic performance, but they also

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have the potential to revolutionize health management, injury prevention, and the optimization of recovery programs (D'Aprile, 2024).

In fact, AI not only monitors aspects such as heart rate, muscle endurance or body composition, but can also analyze more complex variables such as muscle fatigue, metabolic efficiency, physiological recovery and the body's response to different training intensities. Thanks to the ability to perform predictive analysis, AI is able to suggest timely adjustments to training programs, anticipating possible problems and personalizing interventions for each individual, taking into account their specific physiological needs (Facci, 2024). However, the adoption of AI in the improvement of anatomical-physiological parameters does not only concern the technical and scientific aspect. There is an important pedagogical dimension that emerges when these technologies are integrated into the field of physical activity, in particular in the training and education of individuals who practice sports or follow training programs (Li et al., 2024). The use of AI, in fact, should not be seen only as a way to collect and analyze data, but as an opportunity to educate the individual to body awareness, the management of their physical abilities and continuous improvement through self-reflection and self-regulation. In other words, AI can become a pedagogical tool to raise awareness of the importance of a conscious approach to physical activity, where every action and every decision is supported by objective data and precise analysis (Claudino et al., 2019).

The pedagogical aspect of this integration also concerns the training of instructors, coaches and professionals in the field, who must be able not only to use technologies, but also to interpret them correctly and apply them in an educational context that respects the emotional, cognitive and motivational needs of individuals (Wright et al., 2017). The teaching of physical activity cannot be reduced to a simple transmission of technical information, but must include a continuous reflection on the importance of health, well-being and sustainable improvement. In this sense, AI offers the opportunity to foster a change in the athlete's mindset, helping them to become more aware of their body and abilities, but also more able to manage their limits and recoveries independently (Sullivan & Lachman, 2017).

The pedagogical implications of the introduction of AI in physical activity are many: from individualized approaches that take into account the unique characteristics of each body, to the promotion of active and reflective learning, which is not limited to improving performance, but aims at the overall growth of the individual as part of an educational path. Training, therefore, should not only be seen as a means to achieve specific physical goals, but as a process that also promotes the development of mental and emotional skills, stimulating motivation, discipline and a sense of self-efficacy (Koumaditis et al., 2020; Noe, 2020; Bergamo et al., 2022).

In this article, we will explore how Artificial Intelligence is becoming a central element in improving the anatomical-physiological parameters of physical activity, analyzing both the technical and pedagogical aspects of this evolution. We will examine how AI allows for more precise and personalized management of training, improving physical performance and injury prevention, but also how it can play a fundamental role in the training and education of the individual, promoting a conscious and sustainable approach to physical activity. Through the use of advanced technologies, it will be possible not only to optimize physical health, but also to strengthen the awareness and motivation of athletes, preparing the ground for a new era in sports education and body care.

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2. AI Technologies for Monitoring and Improving Physiological Parameters: From Theory to Practice

The integration of Artificial Intelligence (AI) in the monitoring and improvement of athletes' physiological parameters has led to a real revolution in the field of physical activity and sport (Skjæret et al., 2016). Although monitoring techniques have traditionally been based on manual tools and physical assessment methods, the advent of AI technology has made it possible to overcome many of the limitations of traditional methods, offering a highly automated, precise and personalized approach to physical performance management. AI technologies make it possible to collect and analyze large volumes of data in real time, which can then be used to optimize the athlete's training and health, constantly monitoring parameters such as body composition, heart rate, muscle strength, metabolism and recovery capacity (Bunn et al., 2018).

Wearable technology is one of the fundamental pillars on which the use of AI in the monitoring of physiological parameters is based. Advanced sensors, which can be worn by athletes during training or competitions, collect biometric data in real time, such as heart rate, speed, muscle power, body temperature, oxygen saturation and posture (Kenney et al., 2022). Among the most used devices are heart rate monitors, chest straps, sensors integrated into shoes and smartwatches. These tools are able to transmit a huge amount of information directly to AI-powered analytics systems, which can process the data to provide immediate and personalized feedback (Lee et al., 2019).

For example, a wearable device can measure cardiac output during a high-intensity workout, while another muscle sensor can detect the amount of force produced by the legs in a vertical jump. By combining data collected from multiple sensors, AI is able to create a complete picture of the athlete's physical condition, allowing targeted changes to be made to the training program. This data is also constantly updated and sent in real time to coaches, who can monitor the intensity of the training and ensure that the athlete is working at the optimal levels for the improvement of his performance (Wright et al., 2017).

One of the most powerful applications of AI in monitoring physiological parameters is predictive analytics. Advanced machine learning algorithms use historical and real-time data collected from wearable devices to create predictive models, which make it possible to predict the evolution of the athlete's physical performance in the short and long term (Lunney et al., 2016). For example, an AI-based system can analyze an athlete's progress in terms of muscle strength, cardiovascular endurance and resilience, and suggest a specific training program to optimize results based on their physiological needs. If the system detects signs of overtraining or fatigue, it can suggest immediate changes, such as entering an active recovery period or varying the intensity of your exercises (Peake et al., 2018).

These predictive models not only help improve performance, but also play a key role in injury prevention. A thorough analysis of the biomechanics of movement, for example, can reveal abnormalities in motor patterns that could lead to muscle or joint injuries. AI can therefore predict injury risks, allowing corrective exercises or changes in training intensity to be planned. This preventive approach is particularly important for athletes who train at a high level, where recovery management and respect for individual physiological abilities are crucial to avoid long-term damage (Benzing & Schmidt, 2018).

One of the most fascinating aspects of AI in improving physiological parameters is the ability to customize workouts in extreme detail. Traditionally, coaches use generic formulas to determine the volumes and intensity of workouts, but each athlete

has unique physiological responses (Woessner et al., 2021). AI allows workouts to be adapted in real time to individual responses, taking into account a wide range of physiological factors, such as aerobic capacity, muscle strength, recovery and metabolic efficiency. Each athlete has a different body composition, fatigue level, and resistance to exertion, and AI allows this data to be collected and analyzed to create highly personalized programs (Ismailovna, 2024).

For example, an athlete who is looking to improve his speed might receive training focused on high-intensity exercises to improve muscle power and cardiovascular efficiency. At the same time, the AI algorithm can monitor their progress and suggest changes to the program, based on their physiological response, such as a reduction in intensity to avoid overtraining or an increase in intensity to stimulate further improvement.

The ability to receive immediate feedback during training is one of the distinguishing features of AI technologies. AI-based systems are able to analyze the physiological data collected in real time and provide immediate feedback to the athlete and coach (Meena et al., 2023). This type of continuous monitoring is essential to optimize the intensity of your training and maximize the efficiency of your training process. If, for example, AI detects that an athlete is reaching too high a fatigue or stress threshold, it can recommend a break or adaptation of the program, reducing the risk of injury (Urinboevna et al., 2022).

The introduction of real-time monitoring systems allows coaches to more effectively manage the progression of the training load, avoiding overtraining errors and improving the quality of the sessions. In addition, coaches can make decisions based on objective data, avoiding relying solely on intuition or experience, which can sometimes be prone to inaccuracies. (Fabbrizio et al., 2023).

AI not only optimizes the active phases of training, but also plays a crucial role in monitoring recovery. Parameters such as heart rate variability (HRV), muscle recovery time, and sleep are measured to optimize rest and regeneration phases. Using AI, coaches can track the athlete's recovery cycle, assessing sleep quality and the body's response to accumulated physical stress. This continuous monitoring helps to avoid overtraining and ensure that the athlete does not undergo workloads that compromise their physical and mental health (Dergaa et al., 2024).

AI predictive analytics in relation to recovery can determine the best methods for active recovery (such as stretching exercises, yoga, or low-intensity training) or passive recovery (such as the use of compression technologies or massages), thus creating a holistic approach that integrates training and recovery into a continuous cycle of performance improvement.

3. The Pedagogical Role of AI: Educating in Body Awareness and Performance Management

The introduction of AI in the world of physical activity and sport is not only about the technical and performance aspect, but also has important pedagogical implications (Casey et al., 2017). While AI offers advanced tools to monitor and improve physiological and anatomical parameters, its most significant impact may lie in body self-awareness education and conscious performance management. The pedagogical role of AI, therefore, extends far beyond mere technological application, profoundly influencing the way athletes, coaches and sports educators conceive and interact with the human body, its capabilities and its limitations.

Body awareness is the ability to perceive and understand the body's signals during physical activity. This is crucial for an athlete, as it helps to avoid injuries, optimize physical efficiency and improve performance. Traditionally, athletes

develop this awareness through direct experience and feedback from coaches. However, AI is able to amplify and refine this process, offering continuous and detailed monitoring of physiological responses during training (Kamińska et al., 2019).

AI tools, such as biometric sensors and digital platforms, allow a wide range of physiological variables to be detected in real time, including heart rate, oxygen saturation, muscle activity, body temperature, and more. This data provides the athlete with objective information about his or her physical condition, reducing dependence on subjective perceptions or intuitions (Pangrazi & Beighle, 2019). For example, an athlete might think they are not too fatigued, but an AI analysis of their vitals could reveal an onset of overload, suggesting an adjustment to the training program or a break.

AI, in this sense, can act as a "digital mirror", offering feedback that not only improves performance but also educates the athlete to listen to their body. This type of education is not only a technical skill, but implies a change in mentality: the body is not just an object to be trained, but a complex system to be understood and respected. AI helps develop a deeper awareness of how the body reacts to physical stimuli, promoting a holistic view of training (Almusawi et al., 2021). In addition, one of the biggest challenges in training is keeping the athlete's motivation high, especially when it comes to challenging their limits and facing difficult periods. AI has the ability to offer a type of feedback that can encourage the athlete to make more informed choices, capable of positively influencing intrinsic motivation, i.e. the one that arises from within, rather than from the external push (Muxammadjonovna, 2022).

The introduction of AI into training routines allows athletes to receive immediate and personalized answers about how they are progressing, so they can self-regulate their actions during training. For example, an AI-based system might suggest gradually increasing the intensity of the exercise or slowing down when physiological signals indicate that the athlete is reaching their limit. This type of self-regulation allows the athlete to make informed and targeted decisions in real time, fueling their motivation to improve, because progress is easily observable through the data collected.

The use of AI allows you to set short- and long-term goals based on hard data, avoiding the abstraction of traditional goals, such as "getting stronger" or "running faster." Specific, quantifiable goals, such as "increase muscle power by 5% in two weeks," allow the athlete to visualize their progress with greater clarity and determination, reducing the risk of frustration and keeping motivation high (Muratova, 2024,).

The pedagogical role of AI also extends to the training of coaches and sports professionals. Traditionally, the coach has been in charge of observing and interpreting the athlete's physical and emotional cues, offering feedback and modifying the training program based on their own experience and intuition. However, AI allows this approach to be integrated with a scientific and objective component, increasing the coach's ability to interpret data accurately and in a timely manner.

Artificial intelligence can in fact support the coach in identifying patterns in physiological data, which may not be immediately visible to the human eye, such as hidden signs of fatigue, biomechanical misalignments or tendencies towards injuries. At the same time, AI offers the coach the possibility to develop personalized training programs, based on a continuous and detailed analysis of individual performance. This type of science education allows coaches to take a more informed and targeted

approach, improving the quality of sessions and increasing respect for the athlete's physiological needs (Abdumalikovich & Urinboyevna, 2023).

However, a key aspect is that AI does not replace the human role of the coach. Rather, it complements it, allowing coaches to focus more on motivation, communication, and character development, while AI systems take care of technical and physiological analysis. The coach then becomes a facilitator who uses data to improve the athlete's relationship and growth path, with a pedagogical approach that integrates technology with the human dimension of learning (Rashitovna & Baxtiyor o'g'li, 2024).

AI also plays a central role in educating athletes about performance and recovery management. Traditionally, athletes learn to manage their training empirically, developing an intuitive understanding of when to push hard and when to slow down. However, this understanding is often inaccurate and can lead to overtraining or insufficient recovery, which negatively affects performance and health.

AI, thanks to its predictive algorithms and data analysis capabilities, gives the athlete a complete picture of their physiological condition, helping them to plan their training, recovery and rest phases more accurately. For example, heart rate variability (HRV) monitoring, a reliable indicator of recovery, can tell the athlete when the body is ready for another intense session or when a rest period is needed. Awareness of these signals, provided in an objective and scientific way, helps the athlete make more informed decisions and better manage their training and recovery cycles (Djo‘rayevich, 2024).

In addition, through the combination of physiological and psychological data (such as sleep and mood monitoring), AI can teach athletes how to balance not only the intensity of physical exercise, but also mental recovery, which is essential for maintaining high motivation and performance in the long term. This integrated approach promotes holistic performance management, which is not limited to just improving strength or speed, but aims at the overall well-being of the athlete.

4. The Integration of AI into the Motor Learning Process

Motor learning is a key aspect of athlete training, and the introduction of Artificial Intelligence (AI) in this process is rapidly revolutionizing the way motor techniques are taught, analyzed, and refined. Historically, the acquisition of motor skills occurred through a gradual process of repetition, human feedback, and adaptation to bodily sensations. However, AI, combined with advanced sensors and intelligent algorithms, now makes it possible to optimize and personalize this process, improving not only the efficiency of motor learning, but also the speed at which skills are internalized (Zhang et al., 2024).

The monitoring of motor learning through AI is mainly based on the collection of objective data from wearable sensors or computer vision systems, which detect the athlete's movements in real time. These devices, which include accelerometers, gyroscopes, and 3D cameras, allow you to accurately and continuously track the biomechanics of movements, such as joint angle, speed of execution, or gait trend. AI, through machine learning algorithms, is able to analyze this data and provide immediate and specific feedback (Washif et al., 2024). A practical example can be seen in the context of running. Smart shoes equipped with sensors can monitor the athlete's posture, balance, stride, and pressure of the feet on the ground. When the AI detects inefficient movement or misalignment with respect to optimal parameters, it can provide the athlete with real-time feedback, suggesting adjustments in posture or technique. This type of feedback not only speeds up the correction process, but

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also makes it highly accurate, overcoming the limitations of subjective perception and human judgments.

In the context of complex sports such as tennis or volleyball, where coordination and precision of movement are crucial, AI makes it possible to record and analyze every little detail of the technical gesture. For example, an AI system can observe the angle of the arm during service and suggest small adjustments to improve the speed and accuracy of the shot, reducing the risk of injuries related to incorrect techniques.

Each athlete has unique physical, psychological, and biomechanical characteristics that influence their motor learning process. Traditionally, coaches have tried to tailor training programs to individual needs, but often the resources available were limited, and the adaptation was based more on the coach's experience than on precise personalization of the data (Polsley et al., 2022).

With the introduction of AI, it becomes possible to create highly personalized learning paths, based on an in-depth analysis of the specificities of each athlete. AI systems use the data collected to identify the individual characteristics of each movement and determine which areas need more attention. For example, in an athlete who is learning a new swimming technique, the AI could detect that the angle of the arms is too wide or that the stride is too short, and suggest targeted exercises to correct these problems.

In addition, AI can monitor not only motor performance, but also individual physiological responses, such as heart rate, oxygen consumption, and muscle response. These parameters allow you to evaluate the effectiveness of a given exercise or movement, further personalizing the learning process. Athletes who, for example, have low endurance or difficulty in low-intensity movements may receive programs specifically designed to improve these aspects, while those with good cardiovascular endurance may focus on more technical or explosive exercises (Gizar et al., 2022).

AI is not just limited to data analysis, but also integrates with advanced technologies such as augmented reality (AR) and virtual simulation, which offer athletes new ways to improve their motor skills. Augmented reality, for example, can be used to visualize the execution of a movement in real time or to simulate game situations, allowing athletes to practice in virtual environments that faithfully replicate real ones.

An example of the use of AR in motor learning is football training, where the athlete can see, through AR glasses, the ideal angle to kick the ball or the most advantageous position for a pass. This technology provides immediate, visual feedback that helps athletes better understand motor dynamics and strategic choices, reducing learning time and improving movement memorization (Duran et al., 2022).

Virtual simulations, combined with AI, can also reproduce complex game scenarios, such as high-pressure situations, where the athlete must react quickly and precisely. In this context, AI analyzes the athlete's performance in simulations, identifying weaknesses in motor responses and providing practical suggestions for improvement. Simulations allow athletes to train in safe environments, without risk of injury, while AI offers real-time feedback on how to optimize movements.

The psychological aspect should also be considered, a fundamental element in motor learning, since emotions, concentration and motivation directly affect the quality of motor execution. AI can contribute to this by monitoring the athlete's psychological parameters and adapting training accordingly. For example, some AI applications use biometric sensors to detect athletes' stress, anxiety, or motivation levels during training. Based on the data collected, AI can suggest relaxation

techniques, concentration exercises or motivational strategies to optimize the athlete's mental approach to training. This psychological support not only helps the athlete improve his motor performance, but also educates him to manage the emotional aspects that influence his sports behavior (Brons et al., 2021). In addition, the analysis of psychological data makes it possible to recognize situations of stress and burnout at an early stage, which could negatively affect motor learning. AI, therefore, becomes an ally in ensuring a holistic approach to training, which integrates not only the physical and technical skills, but also the mental management of the athlete.

In this context, the integration of AI into the motor learning process represents a real revolution, which is transforming not only training methods, but also the approach to learning itself. Thanks to AI's ability to monitor, analyze and customize the training experience, athletes have access to tools that allow them to refine every aspect of their motor performance with unprecedented precision. The automation of feedback, the personalization of learning paths, the use of advanced technologies such as AR and the management of the psychological aspect are just some of the innovations that make AI an essential tool in the landscape of physical activity and sports (Echeverria & C. Santos, 2021). This change, however, must not obscure the human value of the coach: AI is a resource that complements and enhances the coach's work, but does not replace it, making the motor learning process more efficient, targeted and sustainable in the long run.

5. The Integration of Artificial Intelligence in Sports Training: Sustainable Impacts on Youth Development

The integration of Artificial Intelligence (AI) into sports training is a trend that is gaining ground globally, with increasing application in all levels of sports activity, from professional athletics to youth practices (Dindorf et al., 2022). The adoption of AI-based technologies, particularly in the context of youth sport, is giving rise to new training and skill development methodologies, capable of ensuring a positive and sustainable impact on improving the performance and well-being of budding athletes.

While the use of AI can lead to improved technical quality, it can also be seen as a key asset in protecting the physical and psychological health of young athletes. The technological approach, in fact, has the potential to optimize individual performance, promote targeted and personalized motor education, and support the sports maturation process so that it is healthy and balanced. However, to achieve these goals, it is essential to understand how to integrate AI with an educational and sports model that takes into account not only physical abilities, but also emotional, psychological and cognitive aspects, which are particularly delicate in the formative phases of young people.

One of the most significant aspects of integrating AI into youth sports training is the ability to create personalized training paths that are tailored to the specific needs of each athlete. AI systems, in fact, thanks to their ability to collect and analyze large amounts of data, are able to continuously monitor the progression of the physical and technical abilities of each young athlete, identifying areas for improvement and suggesting targeted exercises (Lee & Lee, 2021).

In the context of youth training, where motor skills are developed in a differentiated way, AI makes it possible to track progress at an individual level, correcting any misalignments or inefficiencies in movements in real time. For example, in youth football, wearable sensors and computer vision systems can analyse speed, accuracy and posture in movements, suggesting specific

improvements. This timely feedback not only accelerates the learning of motor skills, but also helps to prevent the risk of injuries related to incorrect movements or incorrect postures, which could compromise the athlete's physical growth.

Personalized AI-based training adaptation is crucial to avoid training overload or overly intensive training for developing athletes. Young bodies are constantly evolving, and AI, by constantly monitoring physiological parameters, can offer support in balancing the workload, avoiding excessive physical stress that could impair muscle and skeletal growth (Zong et al., 2022).

Injury prevention is one of the areas where AI is showing a significant impact, especially in youth training. The physical and motor adaptation of a young athlete does not always follow a linear path, and the growth phases can lead to imbalances that, if not properly monitored, can give rise to injuries from overload or incorrect techniques. Here, AI can play a crucial role, monitoring not only movements but also vital physiological parameters such as heart rate, blood pressure, oxygen consumption, and muscle recovery.

Through continuous monitoring and analysis of this data, AI-based technologies are able to identify early signs of potential injuries, such as muscle fatigue or changes in movement, alerting coaches and athletic trainers before the damage becomes severe. For example, in the case of a young footballer, AI can detect running patterns that indicate a risk of knee or ankle injury, suggesting the adoption of specific strengthening exercises to prevent such injuries (Xu & Baghaei, 2025).

In addition, training programs, supported by AI, can include optimized recovery periods, taking into account not only physical needs, but also individual responses to the training load, so that the young athlete can express his or her full potential without compromising his or her health.

Alongside the physical aspect, the emotional and psychological growth of youth athletes is a crucial aspect of their training. The use of AI in sports training is not limited to measuring and improving motor skills, but also extends to monitoring and supporting the emotional component. Mental training, in fact, is essential as a young athlete must learn not only to perfect his physical skills, but also to manage psychological pressure, stress, motivation and self-control.

Advanced AI systems, which integrate emotional and cognitive analysis algorithms, can monitor the behavior and psychological reactions of young athletes during training and competition sessions. Technologies such as facial recognition, biometric sensors (which monitor sweating, heart rate, and facial expressions), and muscle tension detection devices can provide crucial data to understand how a young athlete is reacting to the psychological stresses of training or competition. This data can be used to adjust the intensity of training, offering moments of mental recovery or personalized psychological support (Huang & Yongquan, 2025).

AI can also help improve cognitive skills such as concentration and anxiety management, thanks to software that offers relaxation, meditation or visualization exercises, promoting resilience and emotional growth. An example would be a program that guides the young athlete through progressive muscle relaxation techniques or mindfulness exercises, personalized according to his physiological and psychological response.

6. Integrated Sports Education: A Sustainable Growth Model

Integrated sports education is configured as a complete and multidimensional approach that is not limited exclusively to the physical development of the new generations of athletes, but embraces a holistic vision of their growth path, which includes the emotional, social, psychological and cognitive spheres (Morris et al.,

2025). This model differs from the traditional view of sports training, which often focuses only on the technical and physical aspects, and aims to provide athletes with the necessary skills not only to excel in their sport, but also to face life with responsibility, balance and awareness.

In the context of the integration of Artificial Intelligence (AI) in sports training, integrated sports education takes on an even deeper meaning, as AI becomes a fundamental tool for collecting data, analyzing behaviors, monitoring performance and, above all, intervening in a targeted way on the different aspects of youth development. But how is an integrated sports education model concretely implemented? And how can AI support this process?

Integrated sports education is based on a model that considers the athlete as an individual with multiple dimensions, which go beyond athletic performance. The aim is not only to improve motor skills, but to develop a complete athlete who grows up in a healthy, balanced and conscious way. In this approach, the emphasis is placed on several fundamental aspects:

1. Physical development: Obviously, physical appearance remains a central component. The goal is to improve physical abilities, but through the adoption of methods that respect the growth and physiological development of athletes, avoiding overloads and injuries. AI plays a key role in customizing training, monitoring physiological parameters in real time and providing targeted feedback to optimize performance without compromising health.
2. Psychological development: The emotional and psychological component is equally important, as a young athlete must learn to manage the pressure, stress, and emotions related to competition. The ability to stay calm, face challenges with resilience, and handle defeats and wins in a balanced way are essential skills. AI can also contribute to this by monitoring the athlete's emotional response during training and competition, using behavioral analysis technologies to suggest relaxation techniques or mental visualization.
3. Social and relational development: The athlete must be able to work in a team, develop positive relationships with teammates and coaches, and understand the importance of values such as respect, cooperation and fair play. Social training is essential to build individuals who can apply the values learned in sport to everyday life. While AI cannot replace human interactions, it can support coaches in assessing team social dynamics and fostering a positive environment.
4. Cognitive development: A crucial aspect that is often overlooked is cognitive development. Motor training is not just a matter of muscles, but of coordination, reactivity, concentration, and understanding of complex movements. AI offers opportunities to monitor cognitive skills related to motor skills, such as motor memory, the ability to concentrate under pressure, and decision-making speed, and to create training programs that stimulate these faculties as well.

The integration of AI in sports education makes it possible to improve this holistic model, offering tools and solutions that go beyond the traditional figure of the coach. The ability to collect and analyze a large amount of data allows coaches to obtain a detailed and complete view of the physical, psychological, social and cognitive performance of each athlete.

A key aspect of the integrated sports education model is long-term sustainability. This approach does not only seek the immediate result, but aims at continuous

growth and lasting well-being of the athlete. AI contributes to this goal thanks to its ability to monitor and support the evolution of skills continuously, without forcing maturation times and without harming the physical and psychological health of the athlete (Arif et al., 2025).

For example, the use of AI to monitor progress and adapt training according to age and developmental level makes it possible to create growth paths that respect the body's maturation phases, avoiding overly intense early training that could compromise the bone or muscle growth of young athletes. In addition, AI makes it possible to intervene promptly in the event of physical or psychological stress, ensuring adequate recovery and preventing injuries, which are often caused by training that is too intense and lacks adequate rest.

Finally, the integrated sports education model must be inclusive. Sports training must not be reserved only for elite talents, but must be accessible to all, regardless of the physical abilities, economic resources or psychological characteristics of individuals (Alshammari & Alkhwaldi, 2025). AI, through digital platforms and applications, can break down geographical and economic barriers, bringing quality sports education even to the most marginal contexts. In addition, technologies such as behavioral analysis systems can be used to adapt the educational approach to young athletes with disabilities or psychological difficulties, creating inclusive environments that support the development of their skills (Shi & Xu, 2024; Evans & Willis, 2024).

Integrated sports education represents, therefore, a model that responds to the need to train athletes who are not only technically competent, but also emotionally balanced, socially responsible and cognitively ready to face life's challenges. With the introduction of AI, this approach finds new opportunities for application, offering innovative tools to monitor, adapt and optimize the growth path of young athletes.

7. Conclusions

The integration of Artificial Intelligence in the improvement of the athlete's anatomophysiological parameters represents a fundamental step in the evolution of sports preparation. The use of AI technologies to monitor, analyze and optimize physical and physiological parameters offers extraordinary opportunities for improving athletic performance, minimizing the risk of injury and promoting sustainable and lasting growth.

From a pedagogical point of view, the adoption of AI not only allows you to customize workouts according to the specific needs of each athlete, but also favors an educational approach that promotes body awareness and respect for one's physical limits. The ability to monitor the body's response to training in real time allows athletes to learn more about their bodies, to recognize the signs of fatigue and stress, and to consciously manage their physical growth path.

However, it is crucial that the use of these technologies does not replace the human role of the coach, but complements it. The pedagogical aspect, which includes motivation, emotional support and psychological guidance, remains an essential element for the balanced development of the athlete. Artificial Intelligence can serve as a tool to optimize training, but it is the human and educational approach that must be at the heart of athlete training, promoting values of discipline, resilience and awareness.

In addition, the adoption of AI in improving athletes' physiological parameters offers a unique opportunity to integrate cognitive, psychological and social aspects into sports preparation, transforming the training process into a complete educational experience. Through a combination of advanced technology and

pedagogical approach, athletes can develop in a more harmonious, conscious and lasting way, leading to an improvement not only in sports performance, but also in their growth as individuals.

In conclusion, the introduction of Artificial Intelligence in the sports context, if accompanied by a solid pedagogical framework, is able to generate significant benefits, optimizing physical preparation and improving the quality of training, without forgetting the importance of a human and educational approach that promotes the overall well-being of the athlete.

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