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# The role of artificial intelligence (AI) in the mental preparation of high-level athletes

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**Abstract**

The Object of the study aims to identify the role and importance of artificial intelligence in the intervention process of the psychological and mental trainer in high-performance sport. For this purpose, we used the method a descriptive and analytical approach, which is based on theoretical readings and publications related to psychological and mental preparation, as well as modern artificial intelligence tools used to develop athletes' performance. On this basis, the study recommended the necessity and importance of the psychological and mental preparation of the athlete, which has become an essential component of the modern training process, the inclusion of a sports psychologist and/or a mental trainer to manage the different psychological and mental states of athletes, and the organization of study days should be for coaches to teach them psychological and mental preparation techniques, and to introduce them to the different artificial intelligence devices and tools that contribute to the psychological and mental preparation of high-performance athletes.

## 1. Introduction

Since its inception and foundation by American psychologist William Griffit, sport psychology has been considered a science specifically focused on the psychological aspects of elite athletes and the psychological factors surrounding sport competition. Current and recent research in this field is based on international scientific concepts and models from social psychology, cognitive psychology, and health psychology (Decamps, 2015). This field is also one of the specialties that focus on discovering and studying psychological factors in order to improve and develop sport performance. In recent years, significant changes and developments have taken place thanks to the conduct of numerous scientific researches (academic and applied) and the organization of international forums and conferences, thus significantly contributing to its transition from an academic theoretical framework to an applied experimental framework. Among the most important topics currently studied by applied sport psychology is the psychological and mental preparation of athletes. Despite the development of scientific research in this field, it is still experiencing certain stagnation in countries that have lagged behind in this area, particularly Arab countries, and confusion between these two concepts and their relationship has increased. Therefore, this research aims to highlight the difference between them and the dialectic of overlap between these two concepts (in relation to the professions associated with them and the areas of intervention for each of them), and the importance of each of them in modern training planning (individual or team sports) to raise the level of performance of athletes. The objective of mental preparation is to manage the pressures of competition in athletes. Artificial intelligence makes it possible to anticipate these moments of tension to better manage them, and offers unprecedented possibilities to understand and improve the mental state of athletes, and allows coaches to measure and analyze the emotional states of their athletes, to predict their moments of weakness for good psychological and mental care of their athletes (Fabien, 2025).

## 2. Problem and sub-questions of the study

Studies in the field of applied sports psychology have generated considerable controversy and dialectic between psychological and mental preparation, the professions associated with them, and the areas of intervention of each in high-performance sport (Heuze & Leveque, 1998). Many international, regional, and Arab scientific conferences have addressed this type of study, but from multiple angles, using concepts and models based on the different professional interventions at different levels (diagnostic, preventive, and therapeutic) related to

psychological and/or mental problems and factors (for sports competition and athletes).

The process of mental preparation of athletes is no longer limited to the methods and techniques used, such as relaxation, mental visualization and goal setting, and psychological tests to manage stress well. Rather, it has evolved towards the use of advanced artificial intelligence devices that serve as proactive tools for the initial diagnosis of various mental problems that an athlete may be exposed to or face before competition. Currently, the growing integration of artificial intelligence (AI) in sports has gained major importance given its impact on performance improvement and injury prevention. Its applications include predictive analysis to optimize training and early injury detection by anticipating risks related to muscle fatigue (Green et al., 2019).

AI has also been used to model and predict performance based on environmental conditions, such as temperature or humidity. And while we know that the mental and psychological component is very important for sports performance, how is artificial intelligence used to improve the mental preparation of athletes?

Drawing on various theoretical readings and studies on this topic, the research question was formulated as follows: What is the importance and role of artificial intelligence in the psychological and mental preparation process of elite athletes ? This general question also gave rise to several sub-questions: What is the difference between psychological preparation and mental preparation? , How can mental and psychological components be integrated into modern sports training planning (individual and team sports)? , What are the main artificial intelligence devices and tools used in the mental preparation process of elite athletes, and their role in developing athletes' sports performance?.

## 3. Objectives and significance of the study

This study aims to:

-Identify the difference between psychological and mental preparation in elite sport;

- Identify how to integrate psychological and mental components into modern sports training planning (individual and team sports);

- Highlight the various artificial intelligence tools and devices and their use in the psychological and mental preparation process of elite athletes.

## 4. Analysis and discussion

From a scientific and academic perspective, this study is important for clarifying certain concepts related to psychological and mental preparation. From a practical

perspective, it constitutes a contribution or complement to applied research in sports psychology.

Before answering the question about the role and use of artificial intelligence (AI) in the mental preparation of athletes, we first determine the difference between psychological and mental repair in athletes, then we explain how to include the mental component in the planning of the training plan (team and individual sports), and finally we determine the use of artificial intelligence in improving the mental preparation of athletes.

### 4.1. Difference between psychological preparation and mental preparation in athletes

The concepts associated with psychological and mental preparation in sport have been addressed by numerous researchers and appear in various publications and books on sports psychology. In this article, we would like to highlight the difference between psychological and mental preparation, given the controversy and dialectic surrounding the understanding of their role and importance in the athlete and their athletic performance.

Psychological preparation consists of analyzing the factors, elements, or situations that are part of the athlete's sporting project. It is a broad and comprehensive preparation, which can sometimes go beyond the purely sporting context to address other topics related to the athlete's daily life. Therefore, psychological preparation is the dynamic interaction that connects the athlete (as the main actor) with the various factors, individuals, and elements that structure their sporting project. There are several types of psychological preparation, including long-term psychological preparation, short-term psychological preparation, and specific psychological preparation (Al-Zamili, 2020). Mental preparation concerns the athlete's relationship with himself, allowing him to manage his psychological state related to performance and results, which contributes positively to the acquisition of the mental qualities and skills required in competitive sports. Therefore, psychological preparation precedes mental preparation (Heuze and Leveque, 1998). If mental preparation aims to facilitate the learning of motor skills, regulate the athletes' activation level and facilitate physical and mental recovery, it allows athletes to manage stress and psychological pressures (positive or negative) and better prepare for competition by improving self-confidence, motivation and competitive spirit (Moran,Copper &Driskell, 1994). Mental preparation also aims to develop basic mental skills (such as motivation, goal setting, self-esteem, and self-awareness) and performance-related skills (such as self-confidence,

psychological energy, and attention) through the use of some of the following techniques: goal setting, mental visualization, and relaxation.

**4.2. How to integrate the mental component into sports training planning?**

Numerous studies conducted to date highlight the effects of mental training programs on competitive performance (Garza and Feltz,1998). Mental skills were assessed using the OMSAT 3 (Ottawa Mental Skills Assessment Tool) developed by a Canadian team (Durand-Bush, Salmela, and Green-Demers, 2001). How can the mental component be integrated into a modern sports training program?

Before clarifying this point, we will discuss the different categories of mental skills:

Fundamental, cognitive, and psychosomatic skills (Durand-Bush, Salmela, & Green-Demers, 2001).

-Basic skills are essential for optimal mental performance. They include goal setting, self-confidence, and commitment.

-Psychosomatic skills are important for assessing and regulating the energy level mobilized by the athlete. They involve stress responses, fear control, relaxation, and activation.

-Cognitive skills, which include concentration, mental visualization, and competition planning.

**4.2.1. Integrating the mental component (mental skills) into an individual sport (e.g., athletics):**

**-Basic skills (e.g., goal setting) must:**

- At the beginning of the sports season, realistic goals must be set, adapted to the athlete's abilities and preparation.
- The athlete must have the will to achieve these goals.
- These goals must be agreed upon between the coach and the athlete.

These goals may be results-related (qualification for regional, international, Olympic, or world competitions), local, continental, or international rankings, or selection for the national team.

They may also be performance-related (understanding of tactical systems in racing, performance consistency, and physical and technical development).

- **Psychosomatic skills (stress and emotion management):** Here, the intervention of the mental trainer helps the athlete maintain his level of control over the factors of competition, but there are things that can be controlled and monitored and other factors that cannot be controlled.

***Table 1. Presents them as follows***

| *What can be controlled and monitored* | *What cannot be controlled and monitored?* |
|---|---|
| - Preparation of sports equipment materials<br>- Type and level of warm-up<br>- Visualization of competition or ev conditions<br>- Key points to monitor<br>- Final preparation routine for the event | - Weather conditions (wind, rain, humidity )<br>- The competition arena<br>- The state of the competitors<br>- The audience (number, attitudes, behaviors, or reactions)<br>- The jury (their decisions) |

**- Cognitive skills (e.g., concentration in competition)**: The mental trainer's intervention takes place in two (02) stages: during the warm-up and during the competition.

***Table 2. Mental trainer intervention in three (03) stages (during warm-up, during competition and during training)***

| *During warm-up* | *During competition* | *During training* |
|---|---|---|
| Mentally engage in the competition:<br>- By reminding yourself o your goals<br>- By stimulating and motivating your mind<br>- By warming up effective<br>- By isolating yourself fro any distractions<br>(competitors' attempts to disrupt the competition, ar other events) | Control of performance determinants (technique, effor management, appropriate tactical choices) based on set objectives and competitive conditions.<br>- Management of activation levels (vigilance and relaxatio at the right time).<br>- Management of emotions and distractions related to competition. | - Work with quality and mastery in the application technical skills.<br>- Contribute to injury prevention.<br>- Manage effort.<br>- Improve concentration during competition by: Experimenting with variou concentration strategies (visualization, visual cues) |

### 4.2.2. Integrating the mental component (mental skills) into team sports:

Integrating the mental component into training planning is essential through group intervention (group diagnosis) aimed at developing social cohesion, fostering competitive spirit and improving communication within the team. The mental trainer may also act through individual intervention, depending on the (unforeseen) sporting situations and circumstances that the athlete faces in competition. The practical mechanisms to achieve these objectives consist of developing mental skills (concentration, goal setting, self-confidence, psychological energy and attention) depending on the situations and nature of the sporting competition.

The foundations of mental preparation in team sports are based on three major axes: setting goals, regulating emotions, and personal development. These

elements form a structuring framework for each athlete and strengthen team dynamics. The mental trainer acts as a support guide, adapting their strategy according to the context, level, and situation of the group.

***Table 3. Shows the axes of mental preparation in team sports***

| *Setting an objective of collective and individual* | *Managing emotions and though* | *Building Confidence* |
|---|---|---|
| For athletes, having a clear goal promotes motivation ar gives meaning to each session. For a team, it aligns intentions and fosters cohesion. The goal must be achievable and linked to efficiency, commitment, or mental progress. It may occu during competition periods when the group is going through a difficult time; in this case, remembering their shared ambitions helps them stay motivated. | The role of the mental trainer is decode internal signals, calm excessive reactions of the athlet and maintain his optimal state. H must intervene on individual emotions, but also on those of th group, particularly during post-match sessions or in the weak moments of the competition. | Cognitive coaching acts on the latter through mechanism of appreciation, self-assessment and recognition. At the same time, it improve the overall moral state, making the group more emotionally stable and resilient. This promotes a constructive atmosphere and facilitates interactions within the team. |

### 4.3. The use of artificial intelligence in the mental preparation of high-level athletes

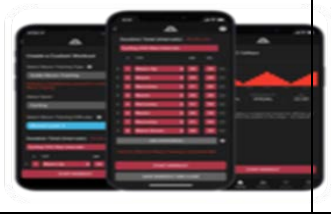
If the main objective of mental preparation is to be able to manage the pressures that can cause anxiety in the athlete, then thanks to Artificial Intelligence (AI) it is possible to anticipate these moments of tension in order to better manage them.

Artificial intelligence (AI) has become a key player in the field of sport, offering unprecedented innovations to improve the performance in team and individual sports. Its use in the mental preparation of athletes, it offers unprecedented possibilities for understanding and improving the mental health of athletes, allowing coaches to measure and analyze the emotional state of athletes, and to predict their weaknesses and provide them with personalized support to improve their performance.

#### 4.3.1. The most widely used artificial intelligence tools in the mental preparation of high-level athletes

Several artificial intelligence tools are used in the mental preparation of athletes, their use by a mental trainer allows to anticipate difficult moments before the competition for good management of tensions and stress.

***Table 4. Shows the artificial intelligence tools used in the mental preparation of athletes***

| *Artificial intelligence tools* | *Definition and domain of use* |
|---|---|
| *Emotiv or Neuro Traker software*   | It is a type electroencephalogram sensor , that can measure brain function, detect stress and concentration levels in athletes and adapt their mental preparations according to the psychological state. |
| BioGraph Infiniti   | These are programs or platforms that analyze breathing, hea rate and the electrical response of the skin to measure the emotional state of the athlete, which allows choosing the appropriate relaxation and breathing techniques for each athlete to better manage and cope with stress. |
| Rewire Fitness  | These are applications that offer mental preparation exercise based on the athlete's needs, which can be used and integrate into the training routine according to their goals. |

## 4.3.2. Integration of artificial intelligence into the mental preparation program of high-level athletes

***Table 5 .Shows us the different stages of the integration of artificial intelligence in the mental preparation of athletes.***

| *Steps of use* | *Description* |
|---|---|
| 1. Assessment of the ment state of athletes | An initial diagnosis of the athlete's condition using the cogniti analysis tool (EMOTIV) allows for the identification of t athlete's mental strengths and weaknesses (lack of concentratio stress management, etc.). |
| 2. Adapting training based on data | The implementation of biofeedback exercises such as relaxati and meditation to help athletes manage stress, the introduction artificial intelligence applications allows better adaptation to t psychological state of the athlete. |
| 3. Real-time traiking and modification | Regular repetition of the first step allows the athlete's men indicators to be monitored and tracked and mental preparati exercises and plans to be adapted based on the rate of progre for continuous improvement. |

## 5. Challenges and prospects for the integration of artificial intelligence in the field of sport

The integration of artificial intelligence in several areas of sport offers athletes the opportunity to improve their performance, coaches to develop strategies for their team's success, and mental coaches to anticipate and diagnose their athletes' psychological and mental problems before competition.

The following diagram shows the different areas of use of artificial intelligence in elite sport.

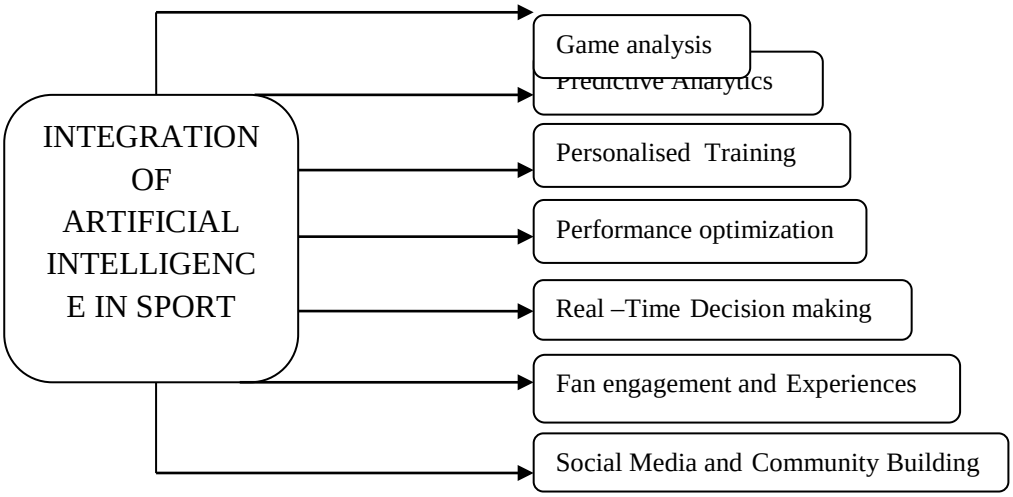



***Diagram 1. Areas of application of artificial intelligence in sport (Terrassa, 2025).***

### 5.1 . Challenges of using artificial intelligence in sport

AI offers athletes and teams advanced tools for performance analysis and strategy optimization, but its unequal access can lead to competitive imbalances.

The integration and use of artificial intelligence in elite sport has become extremely important, providing athletes and teams with highly advanced tools to improve performance. However, it can lead to competitive imbalances if not used legally. Among the challenges of AI, the collection of biometric and behavioral data from athletes can present ethical and legal challenges and must respect the principles of confidentiality and informed consent (Popek, 2024).

Another fundamental challenge concerns the authenticity of sport. By improving the accuracy of refereeing decisions and optimizing athletes' performance, AI could transform competitions into a battle between technologies rather than between individuals (Thompson, 2019).

The fairness and integrity of competitions are also among the challenges of the use of AI in sport; its unequal access can lead to competitive imbalances. Its use

should not create unfair advantages for certain nations or athletes with greater financial resources (IOC, 2024).

### 5.2. **Prospects for the Use of artificial intelligence in High-Performance Sports**

Artificial intelligence (AI) opens up vast possibilities in the field of performance sports, offering opportunities to improve athlete performance, prevent injuries, and strengthen fan engagement. Thanks to technological advances, AI enables increased training personalization, optimized game strategies, and a more immersive interaction between sport and its audience (Nicolas, 2024 ).

More precise and fairer refereeing: Thanks to artificial intelligence, we will have more precise and fairer refereeing; this problem is beginning to be alleviated with tools like VAR (Video Assistant Referee).

These systems use multiple cameras, sensors, and motion detection algorithms to capture and analyze plays with maximum accuracy, which not only improves fairness in the game, but also increases the transparency of competitions and reduces the controversies associated with human decisions.

AI plays a key role in injury prevention by anticipating risks related to muscle fatigue, postural imbalances, or excessive training loads (Green et al., 2019).

The democratization of AI technologies is essential so that all athletes, regardless of their origin or level of resources, can benefit from the same opportunities for performance optimization.

Smart Stadiums Powered by Artificial Intelligence, Stadiums are also becoming smart spaces. They integrate artificial intelligence technologies to streamline access, improve security, reduce energy consumption, and personalize the fan experience.AI also makes it easier for spectators to access the various stadiums by offering them interactive and immersive ways to follow the competitions.

## 6. Recommendations

-The importance of paying attention to the mental and psychological preparation of athletes as one of the most important components of the modern sports training process.

-Integrate a sports psychologist and/or mental coach into the team staff to address the various psychological and mental issues of athletes.

- Organize training days for coaches to teach them the AI tools used in mental and athlete preparation, to anticipate various unexpected or unforeseen competitive situations.

- Integrate the use of artificial intelligence into the mental preparation of athletes.

## 7. Conclusion

Despite its impact and importance on improving the mental performance of athletes, it does not replace the mental trainer, but helps him to anticipate some psychological and mental problems of athletes especially before the competition. It should also be noted that the cognitive and physiological information of athletes is sensitive and strictly personal, it is essential to guarantee their confidentiality and to ensure the athlete's agreement before setting up a mental preparation procedure using artificial intelligence.

To conclude: One of the main challenges of integrating AI into elite sport lies in balancing technology and tradition. With its advanced analytical tools and capabilities, as well as its recommendations, can the technology influence the outcome of a competition?.

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