Publisher
www.theuniversityacademics.com

E-ISSN:2319-3050

International Journal of Research Padagogy and Technology in Education and Movement Sciences

2023 Volume 12 Number 03 JUL-SEP

Review Article

Mental Training and Performance

# Role of Mental Training in Sports Performance: A Critical Appraisal

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DOI:https://doi.org/10.55968/ijems.v12i03.379

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Mental training is very much in vogue, yielding sterling results in sports and athletic performances.A growing body of research in this area constantly exemplifies that mental training is becoming an indispensable part in athletic preparation programme, particularly when physical training inevitably becomes more and more one-sided approach to build a complete athlete. The main objective of this review article is to investigate and understand the role of mental training in sports performance. Studies that matched and fulfilled the primary objective of the article were considered, reviewed, presented systematically and interpreted critically. Different types of mental technique such as self-talk, imagery, goal setting, physical relaxation, biofeedback, mindfulness training, yoga based mental training and cognitive training have been reported as instrumentalto enhance sports performance. Mental training develops an athlete's different psychological skills such as recovery skills, volitional skills, arousal regulation skills, copping skills, motivational skills, perceptual cognitive skills, motor control skills, self-skills and life skills. These skills help an athlete to overcome different difficult situations in the competition and motivate to set a high aspiration. This review study unfolds some fundamental concepts of mental training and its application to nurture and prepare an athlete for better performance.

**Keywords:**

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**How to Cite this Article**

Pramanik P, Chatterjee S. Role of Mental Training in Sports Performance: A Critical Appraisal. IJEMS. 2023;12(03):121-130.

Available From

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| Conflict of Interest | Funding | Ethical Approval | Plagiarism X-checker | Note |
|---|---|---|---|---|
| Nil | Nil | Yes | 13 | |

## Introduction

A gold winning performance oftentimes is at delta difference from a silver winning act. If we dig deep into the phenomenon of this differentiating enigma beyond an esoteric explanation, a huge Mexican wave in the gallery, flashes ofcameras and an intense nerve of the epic moment, we will find a gold winning top performance is pillared upon few logical, scientific and progressive training methods (Figure 1), among them "mental training" is one of the most crucial and instrumental preparations towards a definingmoment of achievement. With the passing of time, modern contemporary spots psychology is underlining time over again the importance of body mind resonance. In sports, while achieving a flow or a peak performance, a well-developed physical body is sometimes of less use compared to a fiery, one-pointed, concentrated and aliened mind and for preparing such mind construct, mental training as a toolhas to be taken care of with critical importance. Here we make an attempt to summarize the research studies related to mental training and its effect on sports performance.

*Fig. 1. Scientific and Progressive Training Methods for Top Performance*

*Enclosed as Annexure 01*

## Overview of Mental Training

The idea of using mental training in sports was first systematically introduced in Soviet Union in 1950s. Later in the 1970s and 1980s, other Eastern Bloc countries, including East Germany and Romania, systematically applied mental training to sports. In 1938, American sport psychologist Coleman Griffith was assigned to the Chicago Cubs professional baseball team to develop the players' performances. In the 1950s, David Tracy was hired as a mental training consultant for the St. Louis Browns professional baseball team. He used relaxation techniques, self-talk, thought- stopping, and hypnosis to help athletes perform. Richard M. Suinn, an American clinical psychologist, evaluated the usefulness of mental training (relaxation, imagery, and behavioural rehearsal) in elite skiers. By the 1980s, mental skills training was promising to become a major focus for research and practices in North American sportpsychology. Today, the application of mental training in sports is growing widely around the world.

Scientific Exposition of Mental Training in Exercise and Sports Science

Mental training is the preparation of an individual's mind to improve and reach their peak performance. Sports psychology considers mental training as an integral part of athletic performance, with a specific focus on helping athletes to break through the mental stigmas that are keeping them from putting forth their peak potential.

Different Techniques of Mental Training

To improve one's peak performance in sports, a number of mental training methods such as self-talk, imagery, goal setting, physical relaxation, mindfulness training, biofeedback, yoga-based mental training, and cognitive training have been proposed by various scholars.A number of research studies have shown only one mental technique practice to increase sports performance, where some other studies have suggested a group of mental technique practices for maximum performance.

Interrelation between Mental Technique, Psychological Skill and Performance Outcome

Mental techniques develop an athlete's different psychological skills such as recovery skills relating with minimizing the prevalence of injury, volitional skills relating with overcoming fatigue and pain, arousal regulation skills concerning with regulating stress and fear, motivational skills, perceptual cognitive skills, motor control skills, self-attitude and adjustment skills. These skills help an athlete to overcome different difficult situations in the competition and empowered them to enhance their performance as given in Figure 2.

*Fig. 2. The Relationship between Mental, Physiological Skill and Performance Outcomes*

*Enclosed as Annexure 02*

## Self-talk and Sports Performance

Self-talk is a widely appreciated mental technique to enhance sports performance. It is an individual's soliloquy, an interpretation of his/her own thoughts rationally or just reading one's own thoughts aloud as a form of self- counselling. Athletes use "self-talk" or "trigger words" as cues to motivate themselves or manage their nerves. In addition, Self-talk builds Self-confidence

That leads to elite performance. This silent cognitive activity, or "self-talk" can be positive (e.g., "I'm ready", "I feel good"), negative (e.g.,"I'm too tired to continue"), instructional (e.g., "look at the ball") and motivational (e.g., "Yes! Come on, let's go!"). Successful Olympians manage their thoughts effectively, making sure they are their best friend at the top of the slope or out on center ice. For example, British Olympian Paula Radcliffe, who won the 2007 New York City Marathon, reported that she silently counted her steps to try to stay focused during the race. As she explains: "I count to 100 three times, that's one mile. It helps me focus on the moment and not think about how many miles I have to go. I focus on breathing andstepping and I go into myself".15So here are some affirmation statements used by athletes in different sporting situations are given in table 1

*Table 1. Examples of Self-affirmation Statements to be used by athletes*

*Enclosed as Annexure 03*

Some review reports which established the efficacy of self-talk on sports performance are discussed here. In a descriptive study, Hardy et al., (2001) examined the four W's (i.e., where, when, what, and why) of self-talk and reported that well-planned, effective self-talk leads to skill acquisition and betterperformance in athletes. Research indicates that national standard skiers using positive self-talk significantly improved their cross-country skiing performance compared to a control condition. For another instance, skilled university level tennis players improved their volley performance at the net after using the triggering words 'split' and 'turn'. It has been documented that female youth soccer player tend to use well-constructed self-talk as a treatment to increase their low-drive soccer shooting performance. Researchers have also shownthat talented athletes use self-talk in a more planned and balanced manner than less talented athletes, who tend to think reactively. Hatzigeorgiadis et al., (2004) hasorganized a study to assess the efficacy of self-talk on thought content and performance on water-polo tasks.For this study, two experiments were performed with a precision task and another power task. Two different types of self-talk were used, namely instructional and motivational. Results indicated that different types of self-talk can be helpful in improving different types of performance (e.g., precision vs. power Tasks). Research has also substantiated that a self-affirmation intervention can improve psychological states (i.e., somatic state anxiety, self-confidence, self-optimization, and self-efficacy) and sports performance of junior athletes. Moreover, Park et al., (2020) has also shown that self-talk is useful in motivating shooting athletes and encouraging effortful behaviour.

Imagery Training and Sports Performance

Imagery is a strategy that can positively influence the sports performance. Vealey and Greenleaf (2001) defined imagery as a creation or recreation of experience or visual image in the mind that seems to be real by using one's senses. For example, Kayla Jean Harrison, an American professional mixed martial artist and former Olympic and world champion judoka, who is seeking to defend her Olympic judo title at the Rio Games, spends time daily imagining success at the Olympic Games. As she explains: "Every night I visualize myself wining the Olympics… I picture myself bombing the girl in the final and standing on top of the podium and watching the flag go up and feeling the gold medal go around my neck and hugging my coach. I visualize all of that every night." Sport psychology today suggests visualizing the positive outcome and what you want from a game or match. This can help to boost athletes' confidence and outlook before sport setting.Imagery has five key characteristics: modality, perspective, angle, agency and deliberation are given in table 2.

*Table. 2.Key Characteristics of the Imagery Process*

*Enclosed as Annexure 04*

Hall et al., (1998) categorized five types of imagery used by athletes: cognitive specific, cognitive general, motivational specific, motivational general arousal, and motivational general mastery.

Research has proved that successful athletes use imagery more enormously and more scientifically than less successful athletes shown in Figure 3.

*Fig. 3. Summary of Research Support for the Effectiveness of Imagery.*

*Enclosed as Annexure 05*

However,Evens et al., (2004) has made a strong argument that 14 weeks of imagery training can improve sports performance (i.e.,clarity, control over anxiety, activity and motivation

Levels, self-confidence, and playing abilities) of a 23-year-old elite rugby union player.Cumming & Hall (2002) has shown thatprovincial and national level athletes use significantly more imagery, regardless of function and physical and technical training, than regional level athletes.In addition to these facts, researches have substantiated that imagery associated with coping strategies significantly affects the sports performance. After an overall estimation it can be said thatplayers use imagery for a variety of reasons related to skill improvement, strategy development and practice, competition preparation, adaptation with venues and psychologicalpreparations, and improving mental skills, as well as coping with several sportingcomplications, such as injuries, hardtraining, and distractions

## Goal Setting and Sports Performance

Goal setting is the cornerstone for elite athletes to great sports performance. Researchers have defined a goal simply as 'what an individual is trying to accomplish; it is the object or aim of the action'. Goal-setting is directly linked up with motivation that effectively empowers athletes to become more productive and effective. Research indicates that there are three main types of goals: (a) process goals, (b) performance goals, and (c) outcome goals. Athletes should use all three to maximize their goal-setting effectiveness as shown in figure 4.

*Fig. 4. Athletes should focus on Combination of outcome, Performance, and Process Goals*

*Enclosed as Annexure 06*

A through study and researches indicate that the goal-setting method is effective for enhancing task-specific acts on-field behaviour in male rugby union players aged 21-24 years. O' Brien (2009) also shown that the goal-setting intervention is effective in consistent improvement in goal-directed behaviour, easier interpretations of anxiety symptoms, and greater self-confidence ofelite boxers whereas in inconsistent patterns of non-elite boxers.In addition, enhancement of sports performanceGould (2001) has used three phases of goal-settingfor coaches including planning, meeting, and follow-up/evaluation phases. Burton and Naylon(2002) have developed a seven-stage model for applying goal setting to athletes' sports performance.

Physical Relaxation and Sport Performance

Physical relaxation technique is an effective technique to enhance sports performance. Specially athletes use progressive muscle relaxation (PMR) and autogenic training to reduce anxiety and to better performance. Progressive relaxation depends on dynamic contraction and relaxing of muscles, where autogenic training depends on feelings associated with the limbs and muscles of the body.

Research has found that regular use of relaxation techniques helps to control athletes' physical energy. Ortiz &Grange (2006) have shown that women golfers' sports performance has been greater improved through a 3 months progressive relaxation intervention when compared to control group.In addition, Parnabas et al., (2014) claimed that progressive muscle relaxation techniques are effective in improving athlete's sports performance. In a noteworthy studyLiang et al., (2021) concluded that one-monthof progressive relaxation training (PRT) has been effective in pre competition anxiety and sports performance among college student athletes.However, research has found that compared to a classical training condition, 6-week classical training plus autogenic training showed a greater improvement in terms of standing stability control while shooting in the French Biathlon, a winter sport. Furthermore, it is also noted that a progressivemuscle relaxation (PMR) and autogenic relaxation (AGR) intervention can regulate the mood of young soccer players.

Mindfulness Training and Sports Performance

Mindfulness training is a key performance-enhancing strategy and is part of the canon of sports psychology. The concept of mindfulness originated from Buddhist meditation practices and has been further developed and modified by various scholars. A key element of mindfulness is, indeed, the non-judgmental focus of one's attention on experience as it occurs in the here and now. Cottraux (2007) defined mindfulness as "a mental state resulting from voluntarily focusing one's attention on one's present experience in its sensorial, mental, cognitive, and emotional aspects, in a non-judgmental way."

Some prominent sports scientists and researchers have conducted several research studies to investigate the relationship between mindfulness training and sports performance. Recent researchsuggests that mindfulness training

May be more effective than other psychological skills training methods for improving athletic performance. Mindfulness-based training can develop physical health, mental health, cognitive and affective outcomes, and interpersonal outcomes as shown by Creswell (2017). Research also indicates that 6 weeks mindfulness traininghad a great effect on the players' flow state, which also enhanced performance. In a prospective event-related study Nien et al., (2020) has shown that 5-week mindfulness training program could increase the level of awareness, endurance performance and multiple cognitive functions, including executive functions and they suggest that mindfulness training can also reduce conflict monitoring in neural processes. In addition,Chen & Meggs(2020) presented an intervention study to observe the efficacy of a Mindful Sports Performance Enhancement (MSPE) program on the mindfulness and flow of sixteen competitive adolescent swimmers. For this study, they were divided into MSPE (n = 9) and relaxation training (RT) (n = 7) groups. At the end of eight weeks, the intervention study revealed significant improvement in global trait flow and action awareness fusion and clear goals subscales for the MSPE group compared to the RT group.The study ofCherup&Vidic., (2019) has made a strong argument that mindfulness training positively affects the factors that enhance athletic performance, such as mindfulness, dispositional flow, and perceived stress among Division-I female gymnasts.Another study byBuhlmayer et al., (2017) has substantiated that mindfulness-based intervention can improve athletic performance.

Biofeedback and Sports Performance

The application of biofeedback arose in the late 1960s from the field of psychophysiology. It is one of the most important methods for improving performance in sports.Biofeedback (BFB) is the use of specialized electronic devices with electrodes and sensors to assess, monitor, and provide feedback on an individual's psychophysiological information. The basic idea of BFB is to provide the individual with information about his/her body's or mind's reactions to different situations.

Figure 5 represents the role of Biofeedback training (BFB) in athletic performance enhancement.It has been shown that competition stress (1) is usually associated with changes in physiological parameters such as increased heart rate, blood pressure, Muscle tension and respiration (2). Based on the psychophysiological principle, physiological changes are associated with the physical and mental state of the athlete. The BFB training process involves learning and improving self-monitoring and self-regulation skills in different BFB modalities (3). The end result is an improvement in the athlete's ability to self-regulate (4), leading to an increase in performance (5) under competitive stress.

*Fig. 5. Biofeedback training and performance enhancement*

*Enclosed as Annexure 07*

Research indicates thattwo months of biofeedback training can help to stabilize emotional arousal of a 20-year-old male athlete, which leads to desired success in sports. Bar-Eli & Bblumenstein (2004)have claimed that biofeedback training has beensignificantly effective in improving performance of Israeli 16–18-year-old pre-elite swimmers.Paul et al., 2012 studied the biofeedback of basketball players (18-28 years old) in optimizing the psychomotor activity. 30 basketball players for this study (Male: Female- 16:14) were included from Amritsar. The participants were randomized into three equal groups. Experimental group underwent heart rate variability biofeedback for 10 consecutive days of 20 min. and placebo group underwent motivational video for 10 continuous days for 10 min. where control group had no training. Research shows that biofeedback training can help train stressed athletes to control their psychophysiological processes related to sport. A gamut of researchessuggeststhat an integrated program of biofeedback and psychological skills training (e.g., relaxation, imagery, self-talk, concentration, breathing, readinessreaction time, relaxation to music) can enhance athletic performance of Canada's Olympic short track speed skating team.

Yoga Based Mental Training and Sports Performance

In modern era, yoga based mental training specially dharana (concentration) and dhyana (meditation) is an evolving tool to facilitate sports performance. "Peak performance is meditation on motion" is a revealing quote from Olympic champion diver Greg Louganis that perfectly encapsulates the important role of meditation in "making the mind quite" for many athletes. Novak Djokovic,

A Serbian professional tennis player explained "Meditation is really important to me; it is one of the main points in my day to day, not only in training or in my tennis career".In yoga based mental training athletes find spark. Joseph William Namath, a well-known American athlete who have engaged the practice of Transcendental Meditation to achieve top performance in sports competitions.

Some prominent sports scientists have done some researches on the effect of yoga-based mental training on sports performance, the gist is discussed as follows:

Solberg et al., (1996) conducted an experimental study of the effects of meditation on shooting performance. 25 elite shooters (men: 21 and women: 4) aged 18-46 years were enrolled in this study. After the initial test shooting, the subjects were divided into two groups: experimental group (n=13) and a control group (n=12). The experimental group underwent ACEM meditation 1 day/week (30 minutes) for 7 weeks, and the control group received no mental training. After the intervention, the authors showed that the score differences between 1992 to 1993 were significantly better in the meditation group as compared to control group ($P<0.05$). There was no significant difference in test shooting between the two groups before and after the intervention.Colzato & Kibele. (2017) has made a strong argument that the distinction between focused attention meditation (FAM) and open monitoring meditation (OMM) seems to be beneficial when considering different types of sports, such as closed-skills sports (i.e., archery, gymnastic) and open-skills sports (i.e., soccer, sailboarding). In addition, researchers have found a positive correlation ($P < .01$) between the use of meditation and sports performance. The practice of meditation not only relaxes the mind and body, but also enhances concentration. These help athletes increase their performance levels in sports. However, it is noted that the practice of trataka (yogic visual concentration) has great impact on shooting performance of children at district level.

Cognitive Training and Sports Performance

In the field of sports psychology, cognitive training has been widely recommended by athletes and coaches as a performance enhancement strategy. This technique focuses on the athletes' thoughts and perceptions. Cognitive Training includes different types of techniques such as cognitive restructuring, mental rehearsal, cognitive appraisal, and self-efficacy.

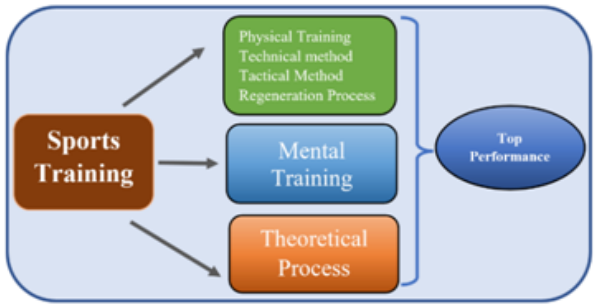
A systematic review and meta-analysis by Slimani et al., (2016) haveshowed that the cognitive training hasgreat effect on soccer performance.In addition, recent research has shownthat cognitive strategies may enhance the athletes' strength performance during competition and training. However, De Witt., (1980) hasreported that cognitive and biofeedback training can reduce stressof university athletes.

## Conclusion

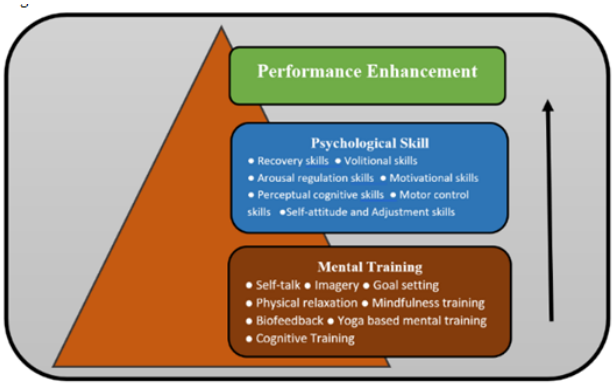
All the psychosomatic trainings in sports constitute a successful sports career and among them, the invisible yet most visible aspect of sport is structured with the faculty of mind. Here in this research study a thorough scientific probing has been made into the corridors of the mind, seeking the answer to the question, "how an athlete can attain peak performance?" and this question is dealt by a systematic, scientific approach where the aspect of mental training has much to say.

## Annexure

*Annexure 01*




*Annexure 02*



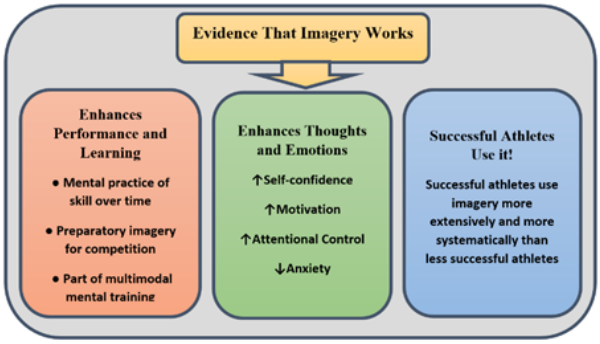

*Annexure 03*

| Sport Situation | Affirmation statement |
|---|---|
| Goalie in Soccer | "Nothing gets by me" |
| Server in Tennis | "I can hit strong and accurate first serve". |
| Shooter in Basketball | "Nothing but net for me" |
| Receiver in Volleyball | "I am consistent and accurate passer" |
| Quarterback in Football | "I have a cannon for a throwing arm" |
| Wrestler | "I am strong as a bull" |
| Golf | "I have the perfect swing" |

*Annexure 04*

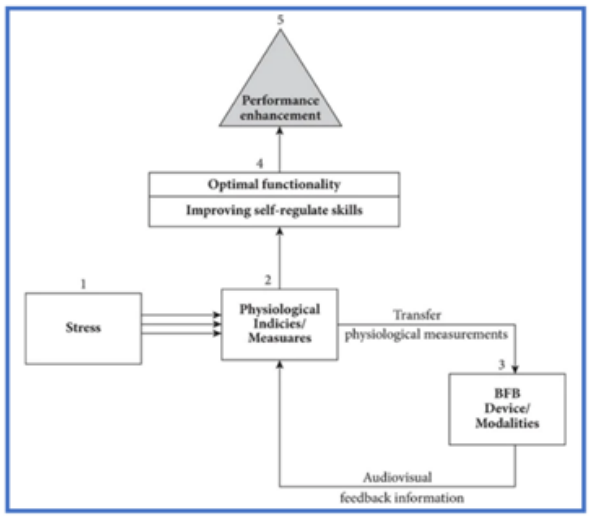
| Characteristic | Definition | Components |
|---|---|---|
| Modality | The sensory modality (modalities) involved. | Auditory<br>Gustatory<br>Kinesthetics<br>Olfactory<br>Tactile<br>Visual |
| Perspective | The visual perspective adopted. | 1PP (internal visual imagery)<br>3PP (external visual imagery) |
| Angle | The viewing angle when imaging in 3PP. | Above<br>Front<br>Behind<br>Side on (from right or left0* |
| Agency | The author or agent of the behaviour being imaged. | Self<br>Other |
| Deliberation | The degree to which imagery is consciously and purposefully. | Spontaneous or triggered<br>Deliberate mental practice |

*Annexure 05*




*Annexure 06*


*Annexure 07*

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