



# Athletes' Mental Preparation Based on Classification of Motor Skills

## 基于运动技能分类的运动心理准备

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**Abstract:** Motor skills can be classified into two categories, open and closed, and each of these types of motor skills has unique characteristics regarding their patterns, features, processes, and neuromuscular control systems that are utilized. Moreover, these two types of motor skills are also controlled by two different types of neuromuscular control systems. Thus, not only should athletes engage in technical training based on the classifications of motor skills, but also, such principles should be applied to psychological training as well. However, many coaches, athletes, and practitioners have not been well informed about the classification of motor skills. Thus, the purpose of this paper is three-fold: (1) describe the different characteristics of open and closed motor skills and their two different neuromuscular control systems, (2) illustrate the determined factors of achieving peak performances in open and closed motor skill sport competitions, and (3) introduce mental preparation strategies for reaching athletes' potentials in competitions based on the classifications of motor skills. After learning the characteristics of open and closed motor skills, hopefully coaches, practitioners, and sport psychology consultants can mentally prepare athletes to enhance their athletic performances.

**Key words:** Mental Preparations; Open Motor Skill; Closed Motor Skill; Athletes; Coaches; Peak Performance

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### 0 Introduction

Motor skills can be classified into various categories based on the specific characteristics of each movement skill<sup>[1-3]</sup>. The execution of sport skills is a neuromuscular control process because the brain makes a decision and then the muscles carry out the planned actions<sup>[2]</sup>. Due to the differences of the neuromuscular control systems, athletes perform open or closed motor skills by using two different control systems, closed loop and open loop control systems<sup>[2]</sup>.

Not only should an athlete's training be based on the specific classification of the motor skills used to train their technical skills, but it should also be based on the classification of type of sport used to guide their mental training. Due to the extreme differences in

characteristics of the open and closed motor skills, athletes' focus of technical and psychological training should both be different due to the differences of the two neuromuscular control systems used to perform these two different types of motor skills<sup>[4]</sup>.

Mental Preparation is a broad term with different contents such as developing of reasoning skill, implementing different strategy, tactics and engage self-control<sup>[5]</sup>. Effective mental preparation can enhance athletes' athletic performance because executed motor skills are controlled by brain and mental preparation plays an imperative role of by helping athletes achieve peak performance. For example, Zealand stated that fencing performance is determined by four factors such as physical condition, mental preparation, technical skills, and tactical strategies<sup>[6]</sup>. Therefore, being mentally prepared for a competition is just as important as being physically prepared<sup>[7]</sup>. Unfortunately, very little to no research studies have been found to address the topic of mental preparation strategies for peak performance based on the classifications of motor skills. Although Taylor proposed a conceptual model for integrating athletes' mental preparation strategies based on the type of sport such as alpine-ski-racing, tennis, golf and so on<sup>[8]</sup>. Taylor only took an initial step for addressing mental preparation based on type of

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sport, but much research work is necessary for explaining mental preparation strategies based on classification of motor skills in order to provide a new framework of proper mental preparation strategies.

Thus, the purpose of this paper is three – fold: (1) describe the different characteristics of open and closed motor skills and their two different neuromuscular control systems, (2) illustrate the determined factors of achieving peak performances of these two distinct classified motor skill systems, and (3) introduce effective mental preparation strategies for athletes training for competitions by using these two different classified motor skills. Hopefully, this paper will provide information to help coaches, athletes, and researchers become aware of the characteristics of the open and closed motor skills so that they, along with sport psychology consultants, can enjoy more success in mentally preparing athletes based on different sport types.

## 1 The Characteristics of Open and Closed Motor Skills

Although there are many different types of motor skills available in sport arenas, all motor skills can be divided into open and closed motor skills based on the competition environments, process of motor skills, dynamic nature, and choice of action because each of these two distinctive motor skill types has its unique characteristics<sup>[3]</sup>. The characteristics of open motor skills are summarized as follows: (1) An athlete cannot make a decision of how to act for the next movement in advance because external stimuli are unpredictable, meaning the athlete must make a quick decision based on the immediate external stimuli<sup>[9]</sup>; (2) To perform open motor skills, quick reaction time is crucial in responding to unpredictable external stimuli successfully; (3) An athlete's action should focus on the result instead of the process<sup>[4]</sup>, so athletes have freedom to take any action to accomplish a specific task at any time in competition as long as an athlete's action is legal; (4) Athletes who perform open motor skills should have great creativity in order to gain an advantage in competition because a creative action can increase an opponent's reaction time to defend; (5) Accuracy of movement is imperative for success. Due to the importance of reaction time in responding to unpredictable external stimuli, open motor skill is also referred to as the reaction time motor skill<sup>[9]</sup>.

Conversely, skills such as gymnastics, diving, figure skating, and long jumping are referred to as closed motor skills. The characteristics of closed motor skills are described as follows: (1) An athlete can make the decision of how to perform motor skills in advance; (2) The competition environment is stable and predictable; (3) The movement routine is predeter-

mined and the performance criteria are already set according to the competition rules; (4) The predetermined performance routine is a standardized criteria; (5) Errors in movement routines are limited and movement perfection should be emphasized for athletes to achieve peak performance. Because athletes compete in closed motor skill competition events, they do not need to react to unpredictable external stimuli, so reaction time is irrelevant to closed motor skills. Therefore, closed motor skills are also referred to as non – reaction time based motor skills<sup>[9]</sup>.

## 2 Neuromuscular Control Systems of Open Motor Skills

### 2.1 Closed Loop Control Systems for Performing Open Motor Skills

To perform open motor skills, an athlete's neuromuscular control system is engaged via the closed loop control system, which characterizes that an athlete must rely on two sets of feedback for the athlete to make a proper decision in performing the next movement<sup>[2]</sup>. One set of feedback is referred to as external feedback. Some examples of external feedback include assessing an incoming ball (its speed, height, direction, curvature, etc.), assessing where opponents are positioned, and assessing where teammates are positioned. The second type of feedback is referred to as proprioceptive, or internal feedback, examples of which include muscle spindle, gerge – tendon organ, and vestibular apparatus that report the information of muscle force, joint position, body position, and so on<sup>[10]</sup>.

An athlete's comparative center is continuously comparing both extrinsic and intrinsic feedback in order to make quick and accurate decisions. Based on both extrinsic and intrinsic feedback, the brain is quickly and continuously sending the proper information to muscles that perform the coordinated movements. Muscles are passive body tissues that only carry out the brain's commands in order to complete the proper actions. Such a system is referred to as the closed loop neuromuscular control system, which provides the feedback in a continuous and on – going fashion<sup>[11]</sup>. To achieve peak performance in open motor skill competition, athletes should enhance their closed loop control system by making quick and accurate decisions to accomplish the immediate goals. Therefore, the focus of open motor skill training is the process of enhancing athletes' ability of controlling the closed loop control system for achieving peak performance<sup>[3]</sup>.

### 2.2 Ways of Enhancing the Closed Loop Control System

Based on the nature and the process of open motor skill executions, five aspects of athletes' abilities

should be trained and improved to achieve peak performance in open motor skill competition and these abilities are described as follows:

(1) Athletes should make a quick and accurate decision. Since the competition environment is unpredictable, athletes must respond to unpredictable external stimuli. The ability to recognize advanced cues and extract meaning from those cues is a characteristic of expert decision makers. Using a GO/NoGo reaction task, Nakamoto and Moris found that basketball and baseball players had significantly shorter reaction times than the nonathletes<sup>[12]</sup>. The decision-making ability can be trained given. For example, video-based perceptual training can improve pattern recognition and pattern prediction ability in basketball players<sup>[13]</sup>. Gabbett et al. also found that video-based perceptual training can improve decision accuracy and reduce the number of recall errors in football players<sup>[14]</sup>. The improvements in pattern recognition and prediction ability transferred to on-field improvements in passing, shooting, and dribbling decision-making skills. Also, moderate exercise speeds up reaction time and impairs the suppression of direct response activation<sup>[15]</sup>. These results can provide guidance for coaches and athletes in training practice.

(2) Athletes should take fast action (fast movement time), such ability largely relies on an athlete's genetic traits and muscular power training. It is no secret that athlete is affected to some extent by genetic traits, such as the strength and performance phenotypes<sup>[16-17]</sup>. Interaction effects between genes and the environment and the identification of genes or coding variants in relation to athlete's characteristics have been also received great attention in research community of sport science. Moreover, researchers have done much to improve athlete's muscle strength. For example, Vaughn and Micheli stated that young athlete should pay attention to resistance training include: the appropriate age of strength training, neuromuscular adaptations, training frequency, number of repetitions, and detraining<sup>[18]</sup>. For example, with the strength improvements, the soccer players gain more shock power and ability to react quickly to stimuli and body-to-body contact<sup>[19]</sup>. Furthermore, based on a longitudinal study conducted by Ruivo et al., they found that 16-weeks strength and resistance training intervention, combined with regular soccer training, led to considerable improvements in upper body strength, muscular endurance, and better results in body composition<sup>[20]</sup>. Also, Strength training can increase athletes' speed to a certain extent. Needless to say, fast speed of executing open motor skills plays a critical role of contributing to the peak performance in competition.

(3) Athletes should perform open motor skills with

great accuracy such as baseball batting, basketball shooting, soccer tackling, football throwing, etc. Open motor skills are generally displayed in the intense or confrontational context. Therefore, toughness of play contributes to achieving peak performance. More importantly, without the accuracy of play, consequence of competing could be compromised because the accuracy of motor skills often determines the performance of athletes. For example, performance of basketball competition is based on successful shooting accuracy and so many researchers conducted studies to investigate variables associated with the accuracy of play<sup>[21]</sup>.

(4) Athletes should learn as many skill alternatives as possible for each type of motor skill for the purpose of lengthening opponent's reaction time. From choice of action perspective, when an athlete has learned more skill movements, he/she has forced an opponent to increase his or her reaction time. From theoretical perspective, choice reaction time is longer than simple reaction time<sup>[2]</sup>. For example, when a NBA basketball team competes to an average basketball team, it is obvious that average basketball players have very difficult time to block the NBA basketball players' actions. One of these phenomena is because the NBA basketball players have learned so many different fake movements, so a defender has to block the ball with more learned defense choices so his/her reaction time increases. Therefore, learning more alternatives of skill movements force defender lengthens his/her reaction time.

(5) Athletes should focus on the results or outcomes of the action instead of focusing on the process of action. For example, a soccer player can maneuver the ball past an opponent by using any form of motor skills as long as no rules are violated, so an open choice of movement executions open the door for developing creative motor skills to gain the advantage in open motor skill competition<sup>[3]</sup>. At the same time, it also requires athletes to concentrate on the competition. A correct anticipation of the opponents' intentions is significant for movement output. Unlike athletes of closed motor skill, who can plan their movements in advance, athletes, who engage in open motor skill, usually perform in a variable environment and they have to adapt their movements dynamically<sup>[22]</sup>. Action anticipation plays an important role in the successful performance of open motor skill, and it may also help athletes focus on the results or outcomes of the action.

### 3 Mental Preparations for Open Motor Skill Competition in Team Sports

#### 3.1 Understand the nature of dynamic process of competition environments

One of the key characteristics of open motor skills in team sports is that there is more than one athlete on a team and some sport teams include over 10 players on one team such as soccer, football teams. Because more athletes on a team, external stimuli increase and an athlete has to pay more attention to many different external stimuli by shifting attention focus quickly and broadly. Competition becomes more dynamic, and athletes must quickly engage in a dynamic attention process in order to make speedy and accurate decisions based on ever – changing situations. Besides that, rapid shift of attention is also quite imperative because speed of competition momentum changes fast and is unpredictable<sup>[3]</sup>. The dynamic of unpredictable competition momentum changes are also reflected in situations when a team is winning or losing. Athletes should have clear plans by mentally preparing themselves on how to react and perform if faced with myriad different scenarios in competition. Especially for certain sports such as soccer, once a team is losing, it can be very hard to come back and win because the team leading can adjust its style and play a defensive game to make it even more difficult for the opponent to come back and win. Therefore, preparing for any dynamic game situation (either good or bad) and developing preventive strategies to deal with each of the possible situations is an important process of athletes' mental preparation<sup>[23]</sup>.

### 3.2 Understand the strengths and weaknesses of your own team and the opposing team

The outcome of open motor skill team sport competition is based on the actions and performances of both teams. Thus, before competition, it is vital for coaches to investigate each team's strengths, weaknesses, key players' style of play, etc. Such a comprehensive investigation of both teams' strengths and weaknesses should be a major mental preparation item. Unfortunately, many strong teams overlook such mental preparation steps and falsely think their team can easily defeat a weaker team, but the lack of preparation could result in a failure. Therefore, without understanding both teams' strengths and weaknesses, the uncertainty of competition outcome is significantly increased regardless of a team's skill level. Professional analysis is essentially a means of recording events so that there is an accurate and objective record of the strengths and weaknesses of your own team and the opposing team. A well – designed system provides the coach with accurate and reliable information that is easily gathered and has an impact on subsequent practice and performance<sup>[24]</sup>. Also, match analysis can be used to identify the strengths and weaknesses of one's own team through the game video and data analysis. For example, a coach could analyze the performance of an opposing team, and identifies ways of countering that team's

strengths and exploiting its weaknesses<sup>[24]</sup>. Observing opposing team's strengths and weaknesses can help own team design better training program, and benefit of physical and tactical training effectively<sup>[25]</sup>.

### 3.3 Effectively communicate with teammates

Many open motor skill team sports feature a large number of participants, such as American football, soccer, rugby, etc. With a large numbers of players competing together, communication becomes a vital part of contributing to team collaboration and implementation of team strategies<sup>[26]</sup>. Therefore, it is imperative for a team to mentally prepare for how to communicate with each other in competition since the field of play of these sports are usually relatively large<sup>[23]</sup>. Thus, communication channels should be developed and every athlete should know how and when to effectively communicate with each other<sup>[27-28]</sup>. Communication among team members is a major component of sport and sport teams' success. Every action of team members should involve in communication, because effective communication is crucial for success in sport<sup>[29]</sup>. In addition, coaches' style may also influence the communication of athletes. The more coaches use positive feedback, social support, and proper training behaviors, the better communication outcome can be achieved with athletes<sup>[30]</sup>. Effective communication among athletes can also help to create team climate, and lay a foundation for the excellent performance of athletes. Compared with the communication among players, leaders' cultivation of a sense of 'we' and 'us' among team members is not just a 'feel good' exercise but one that fuels the achievement of key group goals<sup>[31]</sup>. Also, it is necessary to create more possibilities for a positive emotional feeling to ensure not only achieve high performance, but also a faster recovery after the intense training session.

### 3.4 Implement the effective motivation strategies

For playing open motor skill team sport competition, effort and motivation play a significant role of contributing to team success. Often when a team loses, unity, cohesion, and effort are detrimentally affected so that coordination and collaboration of play will be negatively influenced. Commonly, many teams can play extremely well when things are positive, but these athletes' mindsets may not be able to handle negative situations during competition. As a result, players may begin blaming each other for things that go wrong in competition; thus, a negative atmosphere of team play occurs, drawing focus on each other rather than on the game<sup>[32]</sup>. Thus, athletes must mentally prepare themselves with a tolerance for teammates' errors during games, and still be able to interact positively with teammates to achieve the success of competition. Positively motivating each other among athletes during com-

petition should be viewed as a major mental strategy to adopt for team sport competition, especially at high levels of competition<sup>[33]</sup>. Therefore, a team that gives great effort will achieve more than is expected.

### 3.5 Build athletes' self – confidence

Athletes' determination, courage, and creativity of play in competition come from their confidence. In general, confident athletes can perform well and achieve peak performance in competitive situations. Many research findings have proved that confidence associates with athletes' peak performance<sup>[34–36]</sup>. To develop athletes' confidence level, the first step is to change athletes' perception to focus on self – strength, which requires an athlete to know all of his/her own strengths. The more strength athletes can perceive themselves to possess, the more confidence they have. Strengths of an athlete are multifaceted dimensions such as technical, physical, psychological, learning style, teamwork, spirit, and attitude<sup>[37]</sup>. To cultivate a positive self – perception of an athlete is the foundation of enhancement of increasing an athlete's confidence level. All athletes who play team open motor skill sports should possess strong self – confidence for achieving peak performance.

## 4 Athletes' Mental Preparations for Closed Motor Skill Competition

### 4.1 The Neuromuscular Control Systems for Performing Closed Motor Skills

The characteristics of closed motor skills refers to that an athlete executes a planned movement with an advanced decision – making requirement. An athlete is not required to take an action based on unpredictable external stimuli. Such movement control system of the brain is controlled by another neuromuscular control system referred to as an open loop control system. Based on this system, an athlete is not required to receive continued external feedback to make the adjustments to execute motor skills; instead, the athlete can make a decision beforehand of how to execute a movement routine. One unique principle of performing this type of motor skill is that an athlete executes movements based on the criteria of movement routines without any deviation to such criteria. Thus, athletes' mental preparation strategies should be contrary to mental preparation of performing open motor skills controlled by the closed loop control system that requires athletes to possess dynamic attention styles. With such a striking difference between two different neuromuscular systems, the mental preparation program for executing closed motor skills should focus on consistency of movement routines for athletes to achieve peak performance under stable and unchanged competition environments.

### 4.2 Mental preparation strategies for athletes to compete in closed motor skill competition

#### 4.2.1 Make proper decisions before executing closed motor skills

One of the key characteristics of closed motor skills is stability in a competitive environment so athletes may perform movement routines in a consistent fashion without being required to respond to unpredictable stimuli. Thus, athletes should make the proper decision of executing movement routines in advance. Mental rehearsal should focus on the challenging aspects of movement executions such as transition of technical movements, difficult or high risk movements, or easy – error – making movements. Such mental preparation is an imperative process in achieving peak performance in competition because it is the brain that makes decisions while the muscles simply carry out the movements. If those challenging aspects of movement routines are well prepared for, athletes will be more confident to successfully perform closed motor skills. Thus, advanced proper mental preparation should be one of the crucial processes contributing to peak performance.

#### 4.2.2 Understand biomechanical principles of skill routines

Mental preparation should also be based on biomechanical principles related to particular closed motor skills since movement execution must follow the biomechanical principles to work effectively. For example, a summersault – multiple – rotation routine in the air during the floor event of a gymnastics competition requires sufficient airborne time in order for an athlete to have the ample time to complete the required movement routines. Therefore, the athlete must develop sufficient horizontal linear momentum first, which helps to lift the athlete's body vertically with enough airborne time to allow the athlete to perform the movement routines in the air. From a biomechanical perspective, a slow or fast horizontal approach run both could negatively affect the athlete's ability to lift the body into the air properly. Without the proper application of the biomechanical principle, such movement routines cannot be actualized successfully. Performing closed motor skills is a process of application of biomechanical principles, so both coaches and athletes should prepare mentally to understand each of those related biomechanical principles in order to complete the skill routines successfully.

#### 4.2.3 Make ideal efforts

To perform technical – oriented closed motor skills such as gymnastics or figure skating, giving either too much or too little effort can compromise performance in competition. Closed motor skill competitions require athletes to exert the precise effort to complete the

movement routines smoothly. Thus, athletes should consider using proper effort when performing technical closed motor skills. However, some closed motor skills are strength – related such as weight lifting or short – distance running, and both require maximum effort to accomplish peak performance. Therefore, the application of effort to closed motor skill competition should be based on whether it is a technical closed motor skill or a power – related closed motor skill. Obviously, effort used should be a vital principle to consider in closed motor skill training and competition.

#### 4.2.4 Achieve maximum consistency and accuracy when performing motor skill routines

To compete closed motor skill competition, athletes want to perform motor skills with maximum consistency and accuracy of the movement routines. Because the criteria of closed motor skill routines are predetermined, any deviation of the movement routines away from the criteria could result in a deduction of points or result in a failure of competition. For this reason, the consistency and accuracy of performing closed motor skill routines should be well emphasized. Thus, when athletes are in the conditions of fatigue, injury, or have other mental and physical issues, the practice regimens should be delayed or cancelled because an athlete cannot perform properly under severe fatigue or injury situations. If those situations occur, athletes can engage in mental preparation such as mental imagery training or other non – physical demand activities. Instead, some coaches hate to cancel training even athletes are under fatigue or injury situations. Such practice can only cause athletes to reinforce incorrect movement routines and establish improper motor program habits. To do so, it is obvious that consistency and accuracy of movement executions will be compromised in performing closed motor skill in competition.

#### 4.2.5 Pay attention to technical transitions of performing motor skill routines

Many technical closed motor skills actually include several discrete skills strung together such as gymnastics floor movements or figure skating. One of the characteristics of these types of closed motor skills is that they include many transitions from one type of discrete skill to another, which presents a great challenge to make sharp transitions from one discrete skill to another. Such transitions require a precise application of the force, direction, and movement executions. Any deviation of movement execution to the movement criteria and points will be deducted or worse yet, the athlete could suffer an injury. Many technical closed motor skills require transitions from one position to another under fast speed situations and such transitions become a critical learning element to master the skills swiftly. Athletes' mental preparation in training or competition

should focus on these transitions in order to enable them to perform flawlessly to achieve peak performance.

#### 4.2.6 Ignore external stimuli by focusing on movement routines

An athlete's movement execution of closed motor skills requires athletes with a full attention because the brain makes a decision and muscles carry out the designated actions. Therefore, muscles cannot make mistakes because muscle movements strictly follow the brain's instructions. Hence, the brain's proper decision – making and instructions to the muscles is ultimately a determining factor of the success of an athlete's performance. In order for the brain to send the precise signals to muscles for the designated movement routines, the athlete must have full attention on the task during the process of executing movement routines. History has repeatedly proven that distraction of attention by any irrelevant internal or external stimuli during performing movement routines can cause failure of correctly performing closed motor skill routines<sup>[3]</sup>. A full and concentrated attention during performing movement routines is one of the most important mental requirements for successfully performing motor skills<sup>[38]</sup>. Regrettably, some athletes are easily distracted or influenced by either internal or external irrelevant stimuli while performing closed motor skills. As a consequence, the athletes' performances suffer not because of a lack of technical skills, but a lack of concentration during competition. Especially when an athlete performs a long series of closed motor skills such as when competing in gymnastics or figure skating, which a series of discrete skills strung together to complete the movement routines, not only should the athlete possess full attention at any moment of skill execution, but also, requires him/her have a full attention with a prolonged period of time to complete the entire skill routines. Thus, the elimination of internal and external irrelevant stimuli should be one of the major aspects of athletes' mental preparation program so that the athletes can pay total attention on the task for achieving peak performance. According to Jackson and Csikszentmihalyi, one of the psychological characteristics of Olympic champions is that those athletes achieve the mental state of "relaxed concentration" before competition<sup>[39]</sup>. That implies that these athletes' minds are concentrated on the task and their muscles are relaxed; until athletes achieve such a state of mind and body, regardless of athletic and skill prowess, they may achieve peak performance. Therefore, mental preparation should use the mental state of "relaxed concentration" as the target psychological criteria to develop athletes' mental training programs.

## 5 Conclusion

In the sports arena, athletes compete in many different sports types that can be divided into open and closed motor skills and such classifications are not only relevant to technical training, but it also has a tremendous impact on athletes' mental training. Based on the aforementioned principles, we can see that athletes use two different types of neuromuscular control systems to perform open and closed motor skills distinctively. To execute open motor skills, athletes must rely on external stimuli to quickly make decisions, so reaction time, dynamic attention, quick and accurate movement action, creativity of play, and collaboration with teammates (team sports) is critical. Such a control system is referred to as the closed loop control system. The mental training program should be based on the characteristics of the open motor skill type to be purposefully designed for helping athletes achieving peak performance.

Conversely, athletes performing closed motor skills by using the open loop neuromuscular control system are characterized by making decisions before action starts without encountering unpredictable external stimuli, because the competition environment is stable and unchanged. Thus, the athletes should perform stable and consistent movements to follow the predetermined movement criteria to complete the actions. Any slight deviation of attention during movement executions will result in unpleasant outcomes because the error of movement executions is limited because perfection of movement executions is emphasized.

Based on the discussion on the above, we should not make an assumption that a certain type of motor skill is more difficult to perform than another, but the difference is that these two types of motor skills are controlled by the opposite neuromuscular control systems that are closed loop and open loop control systems. Clearly, the designs of the mental preparation programs should also be different. Coaches, athletes, practitioners, and sport psychology consultants should recognize the differences of the nature of sport types, neuromuscular systems, and their characteristics so that athletes' mental preparation programs can be designed purposefully based on the classifications of motor skills to help athletes achieve peak performance in the two different competition environments.

### References

- [1] MAGILL R A. Motor learning – Concepts and applications[M]. 8th ed. Madison, WI: Brown & Benchmark Publishers,2007.
- [2] SCHMIDT R A, WRISBERG G A. Motor learning and performance: A situation – based learning approach[M]. 3rd ed. Champaign, IL: Human Kinetics,2008.
- [3] WANG J, CHEN S H. Applied motor learning in physical education and sports [M]. Morgantown, WV: Fitness Information Technology,2014.
- [4] WANG J. Key principles of open motor – skill training for peak performance[J]. Journal of Physical Education, Recreation and Dance,2016,87(8):8 – 15.
- [5] ARNOUSA A. The Effect of the Type of Sports' Mattresses on Developing Mental Skills and Tactics for Junior Fencers[J]. Procedia Engineering,2012(34):861 – 865.
- [6] ZEALAND C. Psychological skill training manual[R]. Colorado Spring: United States Fencing Association Technical Report, 2001.
- [7] WALKER S. Mental preparation tips for fencing competition[J]. Podium Sports Journal,2010(1):6 – 11.
- [8] TAYLOR J. A conceptual model for integrating athletes' needs and sport demands in the development of competitive mental preparation strategies[J]. Sport Psychologist,1995,9(3):339 – 357.
- [9] WANG J. Reaction – time training for elite athletes: A winning formula for champions [J]. International Journal of Coaching Science,2009,3(2):67 – 78.
- [10] ROBERGS R A, ROBERTS S O. Exercise physiology – Exercise, performance, and clinical applications[M]. Chicago, IL: Mosby,1997.
- [11] SCHMIDT R A, LEE T D. Motor control and learning – A behavioral emphasis[M]. Champaign, IL: Human Kinetics,1999.
- [12] NAKAMOTO H, MORI S. Sport – specific decision – making in a Go/No Go reaction task: difference among non – athletes and baseball and basketball players[J]. Perceptual and Motor Skills, 2008,106(1): 163 – 170.
- [13] STARKES J L, LINDLEY S, FRENCH K E, et al. Can we hasten expertise by video simulations? [J]. Quest,1994,46(2): 211 – 222.
- [14] GABBETT T J, CARIUS J, MULVEY M. Does improved decision – making ability reduce the physiological demands of game – based activities in field sport athletes? [J]. Journal of Strength & Conditioning Research,2008,22(6):2027 – 2035.
- [15] DAVRANCHE K, PALERESOMPOULLE D, PERNAUD R, et al. Decision making in elite white water athletes paddling on a kayak ergometer[J]. Journal of Sport & Exercise Psychology, 2009,31(4):554 – 565.
- [16] MACIEJEWSKA – KARLOWSKA A, SAWCZUK M, CIESZCZYK P, et al. Association between the Pro12Ala Polymorphism of the Peroxisome Proliferator – Activated Receptor Gamma Gene and Strength Athlete Status [J]. Plos One,2013,8(6):e67172.
- [17] GINEVICIENE V, JAKAITIENE A, AKSENOV M O, et al. Association analysis of ACE, ACTN3 and PPAR G C1A genepolymorphisms in two cohorts of European strength and power athletes [J]. Biology of Sport,2016,33(3):199 – 206.
- [18] VAUGHN J M, MICHELI L. Strength Training Recommendations for the Young Athlete[J]. Physical Medicine & Rehabilitation Clinics of North America,2008,19(2):235 – 245.
- [19] HOFF J, HELGERUD J. Endurance and strength training for physiological considerations [J]. Sports Medicine,2004,34(3): 165 – 180.
- [20] RUIVO R M, CARITA A I, PEZARAT – CORREIA P. Effects of a 16 – week strength – training program on soccer players[J]. Science & Sports,2016,31(5):107 – 113.
- [21] KLUSEMANN M J, HEADRICK J, ARGUS C K, et al. Video – based training combined with flotation tank recovery does not improve three – point shooting in basketball [J]. International Journal of Performance Analysis in Sport,2013,13(1):1 – 10.
- [22] SHIH Y L, LIN C Y. The relationship between action anticipa-

- tion and emotion recognition in athletes of open skill sports[J]. *Cognitive Processing*, 2016, 17(3): 1-10.
- [23] BULL S J, ALBINSON J G, SHAMBROOK C J. The mental game plan: Getting psyched for sport[M]. Eastbourne, K: Sports Dynamics Publish, 1996.
- [24] CARLING C, BLOOMFIELD J, NELSEN L, et al. The Role of Motion Analysis in Elite Soccer[J]. *Sports Medicine*, 2008, 38(10): 839-862.
- [25] BEDIRI S M. A comparative analysis of physical and tactical variables with play positions in final match FIFA World Cup 2014 [J]. *International Journal of Sports Science*, 2016, 6(2): 32-35.
- [26] PASSOS P, DAVIDS K, ARAÚJO D, et al. Networks as a novel tool for studying team ball sports as complex social systems[J]. *Journal of Science & Medicine in Sport*, 2011, 14(2): 170-176.
- [27] WANG J, RAMSEY J. Interpersonal communication - overcoming barriers and improving coach and athlete relationships[J]. *Journal of the International Council for Health, Physical Education, Recreation, Sport and Dance*, 1997(36): 35-37.
- [28] JOWETT S, WYLLEMAN P. Interpersonal relationships in sport and exercise settings: Crossing the chasm [J]. *Psychology of Sport & Exercise*, 2006, 7(2): 119-123.
- [29] SARI I. Effective communication for success in sport[C]. *International Sports Science Congress*, 2010.
- [30] SAR I, SOYER F, YIGITER K. The relationship among sports coaches' perceived leadership behaviors, athletes' communication skills and satisfaction of the basic psychological needs: a study on athletes [J]. *International Journal of Academic Research*, 2012, 4(1): 112-119.
- [31] FRANSEN K, STEFFENS N K, HASLAM S A, et al. We will be champions: Leaders' confidence in 'us' inspires team members' team confidence and performance[J]. *Scandinavian Journal of Medicine & Science in Sports*, 2015; in press.
- [32] TOTTERDELL P. Catching moods and hitting runs: mood linkage and subjective performance in professional sport teams[J]. *Journal of Applied Psychology*, 2000, 85(6): 848-859.
- [33] VALLERAND R J, LOSIERG F. An integrative analysis of intrinsic and extrinsic motivation in sport [J]. *Journal of Applied Sport Psychology*, 1999, 11(1): 142-169.
- [34] JONES G, HARDY L. *Stress in sport: Experiences of some elite performers*[M]. Chichester, UK: Wiley, 1990.
- [35] GOULD D, GREENLEAF C, LAUER L, et al. Lessons learned from Nagano[J]. *Olympic Coach*, 1999(9): 2-5
- [36] MCCALLUM J, VERDUCCI T. Hitting the skids: Serious slumps [J]. *Sport Illustrated*, 2004(3): 53-55.
- [37] VEALEY R, Knight B. Conceptualization and measurement of multidimensional sport - confidence [C]. Paper presented at the Association of the Advancement of Applied Sport Psychology Conference, Tucson, AZ, 2002.
- [38] SINGER R N. Performance and human factors: considerations about cognition and attention for self-paced and externally paced events[J]. *Ergonomics*, 2000, 43(10): 1661-1680.
- [39] JACKSON S, CSIKSZENTMIHALYI M. *Flow in sport*[M]. Champaign, IL: Human Kinetics, 1999.

## 摘要

运动技能对运动员赛场发挥及优异表现具有决定性作用,在运动训练和体育教学实践中也是核心要素。虽然长期以来对运动技能有多种不同的分类方式,但所有运动技能大体上可以分为开放式和封闭式运动技能。基于此,本文主要论述三个问题:(1)解释开放式和封闭式运动技能各自的特征;(2)论述开放式和封闭式运动技能的训练要点;(3)根据两种不同技能分类,介绍心理准备的方法,使运动员在比赛中取得最佳成绩。

开放式运动技能要求运动员必须根据外界刺激做出快速决断,快速反应时间至关重要。运动员的动作应集中于结果而不是过程,因此,运动员可以自由选择任何形式的技能来完成特定任务。另外,开放式运动技能还应有很大的创造性和准确性。与此相反,封闭式运动技能允许运动员有相对充足的决策或判断时间,竞争环境稳定、可预测,且规则和评判运动技能的标准也是预定的。更为重要的是,封闭式运动技能强调技能的完美表现。开放式和封闭式运动技能的执行是通过两个不同的神经肌肉系统:闭环神经控制系统和开环神经控制系统。依据动作技能的不同特征和控制系统,在训练中应具有针对性。开放式运动技能应培养运动员快速决策能力,使运动员在执行运动技能时采取尽可能快的行动,同时,还应对技能的准确性进行重点训练。在科学的训练过程中,应使运动员拥有最大限度的技能储备以应对竞赛中的不同状况。需要指出的是,开放式运动技能的训练或学习应强调结果而不是过程。封闭式运动技能的训练应强调在规则和技能标准的范畴内最大限度保证动作技能完成的准确性,在此基础上进行重复训练,追求技能的完美表现。训练中还应重点对运动员的注意力进行强化。开放式运动技能的心理准备要点包括认知竞赛动态性的本质、了解敌我双方的优劣势、与队友在比赛中有效沟通、实施有效的激励策略、建立运动员自信。封闭式运动技能的心理准备要点包括动作执行之前进行充分的决策、认知运动技能的生物力学特征、根据运动技能的难易准确有效控制发力程度、运动技能表现应确保具有高度的一致性和准确性、充分重视运动技能之间的衔接和转换、高度集中注意力进而有效排除运动技能执行过程中的干扰因素。

**关键词:** 心理准备; 开放式运动技能; 封闭式运动技能; 运动员; 教练; 运动表现

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