Innovation of Athletes’ Individualized Training Mode Based on Analysis of Multi-Level Cognitive Ability

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With internationalization and scientific and technological pace of Olympic movement, sports competition is becoming increasingly fierce. Sports science workers have never relaxed the researching and exploration of sports science, and scientific training level of athletes is increasing day by day. Modern sports put forward higher requirements for athletes, coaches, and scientific research personnel: researching concept of psychological cognition and cognitive ability; using method of literature, researching cognitive ability of sports and the personalized training of athletes. There are many inevitable relations between athletes’ cognitive ability and competitive level. It is the only way for scientific training in the new era to analyze, evaluate, and research athletes’ cognitive ability and its level, and then design training forms, contents, and methods in line with athletes’ cognitive level and personality characteristics.

Keywords: psychological quality, cognitive ability, grade, individualized training, specialty

Preface

The process of people’s understanding of things is an infinite process from phenomenon to essence, from less profound essence to more profound essence. Sports scientific research should understand the essence through sports phenomenon, and then grasp the core law of sports and sports. With the rapid development of modern scientific and technological civilization, the level of sports competition in the world is constantly improving. In any sport, the difference between the physical fitness and skills of excellent athletes is getting smaller and smaller. It is no longer a simple problem of physical skills that determines the outcome of the

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competition. The cognitive ability of athletes is the ability of human brain to receive, process, store, and extract sports information. It is a psychological and intellectual process to acquire and use sports knowledge. It is an important psychological condition for athletes to complete sports. It belongs to the category of sports mental ability. Athletes’ cognitive ability determines their level of learning, mastering, and applying sports knowledge, sports skills, sports skills, and tactics.

The philosophical thinking of “concrete analysis of specific problems” applied to modern sports training is to implement the idea of personalized training of athletes and put it into practice. Sports training is complex physical education project, the task is to let athletes form specific sports efficiency of functional sports force, so that athletes get high self-esteem experience and strong internal drive, constantly break through themselves, its essence is personalized education activities. Sport training is an educational process of training and shaping athletes. Personalized training is the embodiment of the principle of teaching students in accordance with their aptitude in sports. We need to use modern scientific and technological means, cutting-edge professional knowledge, and scientific experimental evidence to analyze problems, solve practical problems in daily training of athletes, and provide scientific basis and practical guidance for personalized training. It is the demand of modern sports science to effectively combine sports cognitive ability with personalized training, to formulate individual training objectives of athletes based on the evaluation of athletes’ cognitive ability and actual needs, and to carry out scientific personalized training with targeted training contents, methods, and means.

**Related Concepts of Motor Cognition**

Cognition is a psychological term. It is a psychological behavior or process in which external information obtains and applies knowledge through feeling, perception, thinking, and experience analysis (Oxford Dictionary, 2020). The cognitive process includes the use of existing knowledge and the generation of new knowledge. In other words, cognition is a process in which the human brain receives external information, processes it and transforms it into internal psychological activities, so as to acquire knowledge or apply knowledge. The main elements of cognition are: feeling, perception, thinking, imagination, memory, and language. Cognitive function is the advanced neural activity of human and animal brain, mainly including all aspects of mental and intellectual activities, such as feeling, perception, learning, and memory, among which the most important is learning and memory (Oxford Dictionary, 2020). Cognitive abilities is the most important psychological condition for people to successfully complete activities, and it is the ability of human brain to process, store, and extract information (Oxford Dictionary, 2020).

Cognitive function and cognitive ability are important knowledge concepts in cognitive theory. A correct understanding of these concepts is helpful to the research of motor cognition. Based on literature research, it is believed that cognition is a unique function of human brain. After receiving objective things or external information, brain obtains knowledge or experience and forms internal stable psychological activities after processing, such as thinking, imagination, calculation, understanding, judgment, and memory. This process develops circularly and continuously obtains new knowledge and experience (see Figure 1). Cognition is one process of psychological and intellectual activities of constantly acquiring and applying knowledge. Sports cognition is one cognitive activity related to sports, which determines the level of athletes’ learning, mastering, and using of sports knowledge, sports skills, and tactics.
Table 1

First Level Elements and Characteristic Contents of Sport Cognitive Ability

| Sport cognitive ability (Primary element) | Characteristics of elements |
|------------------------------------------|----------------------------|
| Sports perception                        | Acuity                     |
| Sports attention                         | Concentration              |
| Sports thinking                          | Overall                    |
| Sports imagination                       | Predictability             |
| Sports memory                            | Integrity                  |
|                                          | Accuracy                   |
|                                          | Distributivity             |
|                                          | Agility                    |
|                                          | Inferentiality             |
|                                          | Clarity                    |
|                                          | Rapidity                   |
|                                          | Stability                  |
|                                          | Flexibility                |
|                                          | Suggestibility             |

Research on the Structural Elements of Athletes’ Cognitive Ability

Based on the basic theory of psychology, this paper divides the components of the first level elements of sports cognitive ability, concretely describes the main characteristics of the first level elements of sports cognitive ability, summarizes the structural elements of sports cognitive ability and their characteristic contents,
and designs the multi hierarchical structure model of sports cognitive ability (see Figure 2 and Table 1 for details).

Sports perception mainly includes space perception, time perception, and speed perception. Sports thinking mainly include operational thinking, predictive thinking, and tactical thinking. Sports attention mainly includes motor observation and attention distribution. Sports imagination mainly includes imagery training and competition imagination. Sports memory mainly includes short-term memory, long-term memory, and motor memory. According to the research needs, the sub-elements of the primary elements are regarded as the secondary elements of motor cognitive ability; the main characteristics are summarized, as shown in Table 2.

| Sports cognitive ability | Characteristic contents |
|-------------------------|-------------------------|
| Primary elements        | Secondary elements       |
| Sports perception       | Action time             |
|                         | Accuracy                |
|                         | Rapidity                |
|                         | Predictability          |
|                         | Durability              |
| Speed level             | Agility                 |
|                         | Accuracy                |
|                         | Reactivity              |
| Spatial direction       | Accuracy                |
|                         | Stability               |
|                         | Predictability          |
|                         | Rapidity                |
| Sports attention        | Movement observation    |
|                         | Accuracy                |
|                         | Agility                 |
|                         | Overall                 |
|                         | Clarity                 |
| Attention allocation    | Concentration           |
|                         | Overall                 |
|                         | Flexibility             |
|                         | Stability               |
| Sports thinking         | Operational thinking    |
|                         | Agility                 |
|                         | Effectiveness           |
|                         | Pertinence              |
|                         | Flexibility             |
| Predictive thinking     | Accuracy                |
|                         | Pertinence              |
|                         | Effectiveness           |
|                         | Flexibility             |
| Tactical thinking       | Pertinence              |
|                         | Effectiveness           |
|                         | Flexibility             |
|                         | Overall                 |
| Sports imagination      | Imagery training        |
|                         | Logicality              |
|                         | Pertinence              |
|                         | Predictability          |
|                         | Suggestibility          |
| Competition imagination | Inferentiality          |
|                         | Predictability          |
|                         | Pertinence              |
|                         | Suggestibility          |
| Sports memory           | Short-term memory       |
|                         | Timeliness              |
|                         | Clarity                 |
|                         | Relevance               |
|                         | Integrity               |
| Long-term memory        | Clarity                 |
|                         | Integrity               |
|                         | Relevance               |
|                         | Timeliness              |
| Recollect memory        | Relevance               |
|                         | Timeliness              |
|                         | Clarity                 |
|                         | Integrity               |

There are still many deficiencies in the above induction and summary of the structure model of the secondary elements of athletes’ cognitive ability. There are also many imperfections in the collation of the primary elements of athletes’ cognitive ability and the induction of the characteristics of the secondary elements, which need to be further revised in the future study and research. Combing the components and characteristics of sports cognitive ability is helpful to clarify the level differences and individual characteristics of athletes in cognitive ability, and provide clear goals and tasks for personalized training.

**Summary of Personalized Training**

Individualized training is training activity of selecting, organizing, and managing sports training based on athletes’ spiritual character and individual characteristics. Traditional sports training lacks detailed consideration and customization for athletes’ individual characteristics in goal-setting, training direction, training content, method selection, and training load arrangement, so athletes’ adaptability to collective training is easy to cover up their individual training needs. Therefore, many coaches are easy to fall into the dilemma of slow improvement of athletes’ competitive ability and poor training effect. High level athletes in different events have their own unique individual characteristics, and their core competitive abilities are different. To study the constitution of core competitive ability of athletes in different events is to research the essential characteristics of sports events. If can’t solve practical problems in process of daily sports training according to
the individual characteristics of athletes, even with the help of advanced science and technology, can’t effectively improve the competitive level of athletes.

Individualized training refers to the training behavior that trainers comprehensively and comprehensively select the appropriate training content, method, load, and arrangement according to the physical and mental characteristics and training objectives of each athlete according to the competitive ability structure and successful competition needs of different athletes (Lu, 2011). Personalized training is an inevitable requirement for athletes to carry out effective training, and the lack of personalized training will lead to difficulties in improving athletes’ special competitive ability (Wang, 2015). Personalized training method is reflected in the formulation, implementation, inspection, and evaluation of training plan, which is conducive to improving the scientific training level, mobilizing the enthusiasm of athletes in training, saving “time cost”, and improving training efficiency (Pu, 2011). According to the competitive ability structure of athletes in different events and the needs of successful competition, coaches comprehensively and comprehensively select the appropriate training content, method and load according to the physical and mental characteristics and training objectives of each athlete (Wen & Tian, 2007). Individualized training is an important way to complete sports training tasks and goals. It is a kind of special educational behavior. Coaches train athletes in groups and grades according to the level of each element of athletes’ competitive ability, training goals, and stage tasks, and according to athletes’ competitive state, ability level and psychological cognitive characteristics. Methods and psychological hints and guidance to implement the “differential treatment”, “individualized” principle of physical education activities.

The training organization form of high-level athletes is mainly collective training, and appropriate training groups are the necessary guarantee for the implementation of personalized training (Wen & Tian, 2007). After grouping, according to the level of different competitive ability elements and psychological cognitive level, the training content, load requirements, and psychological adjustment of individual athletes should be “suit measures to local conditions” and “suit measures to time”, so as to meet the individual training needs of athletes and achieve the individual training objectives of athletes. The individual training of athletes is inseparable from the organizational basis of collective training. The one-to-one teaching and training is expensive in the allocation and utilization of time and resources, and has low universality. Therefore, collective training and personalized training are bound to be an organic and unified whole. They are interrelated, interactive, and inseparable. Individualized training should be carried out on the basis of good collective training, which has high requirements for the internal drive and will quality of athletes. Being proficient in work and thinking, coaches must constantly improve their professional quality and teaching ability.

Design and Formulate the Principle of Personalized Training

Modern sports training requires coaches to constantly improve their professional quality, to elaborate every detail of teaching and training, to design better exercise forms and action combinations according to the personalized needs of sports, to apply sports biomechanics knowledge to design and improve action structure, rhythm and combination of physical exercises, and to make scientific diagnosis of technical training. Based on the analysis, evaluation and research of athletes’ cognitive ability, physiological and psychological knowledge is applied to the monitoring of sports training process, and provides a reliable reference for scientific selection, training, and competition.

The individualization of elite athletes’ training process is the core of sports training theory. The principle of individualized sports training is to more fully match its content, method, form and the value and dynamics of
athletes’ personal skills. The training process of athletes should be constantly revised according to the dynamics of athletes’ personal conditions and the objective information obtained in the complex teaching control process (Kolesnik, 2007). To implement the principle of individualized training, we should consider the following factors: (a) athletes’ cognitive ability and training level; (b) external environment factors, training load plan, and athletes’ individual characteristics; (c) competitive ability with priority development; and (d) differences between men and women in physical preparation, psychological characteristics, motivation, and goal orientation. The development of personalized training must be based on the following characteristics of athletes: (a) cognitive level and training level; (b) external environmental factors, individual types, and characteristics; and (c) age, gender, body shape, and psychological characteristics (Kolesnik, 2007). Personalized training has the main characteristics of individuation, pertinence, innovation, and flexibility. Personalized training is a high-level display of the principle of differential treatment in training, and also a necessary process for athletes to develop to a high-level training stage. The quantity and quality of coaches, the good relationship between coaches and athletes, and the high cognitive ability and understanding of athletes are the guarantee of personalized training for excellent athletes (Pu, 2011).

Psychological quality is the comprehensive embodiment of personality quality and psychological ability, which is formed on the basis of heredity, under the influence of education and environment, through the main practice training. The psychological ability includes cognitive ability, psychological adaptability, and internal motivation. The psychological quality of athletes in the competitive process will show obvious personalized differences, and this personalized difference comes from athletes’ different psychological cognitive ability and level. Therefore, modern sports training needs to be based on the scientific and systematic evaluation of athletes’ cognitive level, so as to design and formulate the content, form, and method of athletes’ personalized training.

**Thinking of Personalized Training based on the Research of Athletes’ Cognitive Ability**

With the improvement of the world competitive level, the level of personalized training of elite athletes is also increasing, but the personalized needs of athletes in training are easily covered by the surface phenomenon that athletes have similar adaptability to training. Appropriate training group is the necessary guarantee for the implementation of personalized training (Wen & Tian, 2007). In the process of training and competition, the different characteristics of athletes’ attention ability are closely related to their sports cognitive activities. Improving athletes’ cognitive sports ability and functional efficiency will help to improve the effect of sports training and enhance competition performance (Danilov & Chichenko, 1998).

Sport training is different from the design or processing of relatively fixed objects. It integrates the most comprehensive educational theories, methods, and means. It is the most complex, top-notch, and most difficult periodic systematic education project. According to the ultimate goal of the human body, sports training should comprehensively evaluate and predict the complex structure, physiological function, and psychological characteristics of the human body, combine the overall education with individual education, combine the comprehensive education with personality education, and combine the collective practice with the group (grading) practice, so as to improve the goal, principle, form, content, method, means, and load of sports training. In order to achieve the goal of sports training and complete the successful shaping of individual athletes, it is necessary to carry out careful design, scientific monitoring of the periodic sports training process, and effective protection and regulation of the phased training results. Different essential characteristics of sports determine that sports training must be an education system with diversified structure (see Figure 3). The
characteristics of competitive ability of athletes in the same event also have great differences, which determine that sports training must need personalized teaching design. The core competitive ability of any sports athletes has complex and diverse elements. Different competitive ability elements can be effectively improved through targeted and professional training.

![Schematic diagram of wheel drive mode for personalized training of athletes.](image)

1. Personalized training is a special type of sports training, and it is an important way to complete the task and goal of sports training. Individualized training requires that the training time, content, load, and resource allocation and utilization should be different from person to person. Overall allocation and grouping and grading training are effective solutions. However, how to scientifically train athletes in groups and grades is an extremely important and urgent task in modern sports training.

2. Individualized training is a kind of special educational behavior, which is carried out by coaches according to the level of each element of athletes’ competitive ability, training objectives and stage tasks, according to athletes’ competitive state, ability level, and psychological cognitive characteristics, and in terms of training content, training load, training methods, and means, as well as psychological hint and guidance. Physical education activities based on the principles of “differential treatment” and “teaching students in accordance with their aptitude”.

3. Group training is an organizational form of collective training. The premise is to classify and grade the athletes in the group based on certain categories and standards. The athletes of the same or the same level are grouped into a group to carry out differentiated teaching and training. After grouping according to the level of different competitive ability elements and psychological cognitive level, the training content, load requirements and psychological adjustment of individual athletes should be “treated differently”, “teach students in accordance with their aptitude”, “suit measures to local conditions”, and “suit measures to time”. Group training is the main method of personalized training. Group practice based on different cognitive levels is the main way to carry out personalized training.

4. Hierarchical training is the level differentiation of personalized training, which helps athletes to establish model goals and achieve self goals. After grouping and grading, sport training is no longer a simple
collective teaching or training. The strength of role models will be formed naturally and imperceptibly, but it is very clear. Every athlete will clearly realize his level in the team, and the role of role model education can be effectively played in mutual competition and learning.

5. The individual training of athletes is inseparable from the organizational basis of collective training. Collective training and individual training are bound to be an organic and unified whole. They are interrelated, interactive and inseparable. Personalized training should be carried out on the basis of good collective training. Modern sports training is to actively implement the idea of personalized training in collective training. Its purpose is to achieve the overall training goal and achieve the best effect of personalized training.

Main Conclusions

1. Modern sports training is to actively implement the idea of personalized training in collective training. Its purpose is to achieve the overall training goal and achieve the best effect of personalized training.

2. Personalized training is a special type of sports training, and it is an important way to complete the task and goal of sports training. Individualized training is a kind of special educational behavior. Coaches train athletes in groups and grades according to the level of each element of athletes’ competitive ability, training objectives, and stage tasks, and according to athletes’ competitive state, ability level, and psychological cognitive characteristics. They implement the “zone” in training content, training load, training methods, and means, as well as psychological hints and guidance. Don’t treat the physical education activities based on the principle of “teaching students in accordance with their aptitude”.

3. Group training is an organizational form of collective training. The premise is to classify and grade the athletes in the group based on specific categories and standards. Athletes of the same class or the same level are grouped into a group to carry out differentiated teaching and training. After grouping according to the level of different competitive ability elements and psychological cognitive level, the training content, load requirements and psychological adjustment of individual athletes should be “treated differently”, “teach students in accordance with their aptitude”, “suit measures to local conditions”, and “suit measures to time”. Group training is the main method of personalized training. Group practice based on different cognitive levels is the main way to carry out personalized training.

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5. The individual training of athletes is inseparable from the organizational basis of collective training. The one-to-one teaching and training is unreasonable in the allocation and utilization of time and resources. Therefore, collective training and personalized training are bound to be organic and unified whole. They are interrelated, interactive, and inseparable. Personalized training should be carried out on the basis of good collective training.

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