Examination on Tennis Training Based on Animal Bionics

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Abstract: With the sustained and rapid development of China's economy, the income of residents has also grown rapidly, and the people's living standards have also been continuously improved. To a certain extent, it has promoted the development of China's sports industry and has also achieved some eye-catching effects, these achievements have also promoted the improvement and breakthrough of the level of tennis in China, increased the enthusiasm of the masses to participate in tennis, and injected vitality into the sustainable development of tennis in China. Now that living standards have improved, tennis has changed from rich people's activities to popular entertainment, but tennis is a fierce confrontation and easy to get hurt, but the lag of tennis training research restricts the development of safe tennis entertainment. This article is a study of tennis training process, through the imitation of animal movement protection and movement; tennis training is carried out to achieve safe tennis training. This article is mainly realized by ant movement. By simulating the movement process of ant animals, design a set of training plans and models, through simulation experiments and field experiments, the results It is shown that the animal bionic training mode has obvious effects on the tennis player's positive and negative hand techniques, and both positive and negative hand have improved significantly. Although the traditional training mode, the athlete's tennis is positive, the backhand is also slightly improved, but only thanks to the long practice, the ball feel of the students hitting the ball is improved, which is different from the technology. Animal bionic training mode has a positive effect on ameliorate and improving the physical fitness of athletes. Through training, the athlete's speed, endurance, and sensitivity of the three physical qualities have a more significant improvement, and the speed quality of the boys is more significant than that of the girls after the experiment. At the same time, flexibility and sensitivity have also been improved to some extent, but relatively slow.

1. Introduction

Today's sports science and technology competition is increasingly fierce. In order to improve sports performance, there must be scientific training methods and means. Sports competition is a

big competition for science and technology. The guiding ideology for implementing the scientific and technological work of competitive sports is to comprehensively implement science and technology. In the tennis training, we collected a large amount of monitoring data. Faced with such a large amount of data, how to comprehensively use it to help coaches, athletes improve their training level and effectiveness, and achieve excellent results in the competition, making these valuable data information play its due role, is an urgent problem to be solved [1,2]. In response to this problem, the State Sports General Administration has put forward the requirements for the development of the "national team information platform". According to the different situations of each national team, the informatization platform will be built in batches. As one of the most promising gold medals in the Beijing Olympic Games, tennis also has a good scientific research foundation. Therefore, the national tennis team became one of the first 13 national teams to build a national science and technology training information platform..

The tennis program is a highly skilled sports competition. The training method and the quantitative analysis of the training load are very complicated. At present, the research on this aspect is still relatively rare at home and abroad. Many coaches lack scientific and quantitative statistical analysis of existing data when developing training programs and programs for athletes [3]. On the other hand, the diagnosis of the athlete's stress on the training load should be a multi-index, multi-level, multi-factor overall assessment, in which the athlete's physical function status is a very important factor [4]. At present, the physical examination of the national tennis team athletes is ce to the coaches to grasp the athlete's physical condition in time and make corresponding training adjustments. Corbishley, A summarizes animal bionic training into two major features. One is controllability, and the other is uninterrupted [5]. In terms of controllability, the biggest feature of animal bionic training is that it can effectively control the training process. Through the control of training load, density, intensity and intermittent time, it can effectively improve the rationality of training, scientific [6-8]. In terms of non-interruption, animal bionics can save time, improve efficiency, and enable uninterrupted practice. It can solidify its basic skills and improve weak technologies, thus improving the integrity and consistency of motor skills.

The so-called bionic training bodywork method is a kind of animal movement, which is usually an animal bionic, that is, imitating the animal's action poarried out by a special research institute. The information feedback takes a period of time, which is not conducivsture, demeanor and life habits, and taking its own physical activity, breathing and breathing, and psychological adjustment as the main form of exercise to achieve health. Physical and mental, exercise methods of healthy exercise [9]. The animal bionic training method is a method used in the training practice of ball games to train technical and tactical training for ball games. Rapp, & Michael A. believes that animal bionic training refers to the training method of single or multiple technical movements through a variety of feeding methods and diversified load methods according to certain training procedures and requirements [10]. Huuskonen, A. believes that animal bionic training is a training method that uses different rhythms and different forms of supply to improve the level of skills and tactics and enhance physical fitness [11]. It is mostly used in the training of small balls such as tennis. An efficient, easy to control method.

Bionic training exercises have been accepted and valued by more people with their unique fitness functions, and have become an effective sports method for the healthy and healthy minds of the whole nation. Faced with a fast-paced lifestyle and a prevailing sub-health state, the method of tune-up training, pranayama, and pacing is the golden key to the modern people's enjoyment of the tennis program. By studying the historical origin and development of animal action bionics, this paper explores the relationship between human head and neck, hand, leg tennis ant action bionics and nature, which has a significant role in promoting the development of tennis training. Theoretical analysis proves that a feedforward network with a single hidden layer can map all continuous

functions. Only when learning discontinuous functions, two hidden layers are needed. Increasing the number of hidden layers can improve the nonlinear mapping capability of the BP network, but the number of hidden layers exceeds a certain value, which in turn degrades the performance of the network.

2. Proposed Method

2.1. Overview of Bionics

Bionics is synonymous with high technology. It refers to the use of cutting-edge science and technology to imitate the various functional sensations and thinking functions of living things, and to serve the number more effectively. Countries are sparing no effort to increase research in bionics. Bionics can "make the structure, function and working principle of graduate students, and transplant these principles into engineering technology to invent instruments, devices and machines with superior performance and create new technologies". The range of imitation creatures is very wide, with model birds bionic, mold fish bionic, mold frog bionics and so on. There are countless bionic objects in nature, so the biological bionic forms in human life are also innumerable and diverse. China's bionic technology has a long history and a long history. According to legend, the ancestors of the Chinese nation saw that the nest saw the bird's nest in the tree, and suddenly touched the inspiration, imitating the bird nesting on the tree to defend against the attack of the beast. At the end of the primitive society in China, the ancient working people, according to the fish in the water with the swinging tail swimming forward, turning and eating, etc., the wooden paddles were placed on the stern, gradually changed into shackles and rudders. The ship has increased its power and mastered the navigation technology that makes the ship turn. People imitate fish to make a boat, they can drive on the water, and people naturally want to fly in the air. The red-crowned crane, known as the "dess of the wetland", is the auspicious bird of the Chinese nation. The red-crowned crane is a symbol of good fortune and longevity, and the red-crowned crane naturally becomes a bionic object.

Ionic design, also known as design bionics, is an emerging edge discipline developed on the basis of bionics and design. Natural forms such as life and plants show us unlimited beauty with its own richness. The existence of this highly sensitive beauty is often used as a reference for designers. In ancient times, humans seem to realize that they can understand the true meaning of their own survival, development and progress from the natural ecosystem. Human beings from the era of obscurity into the civilized era developed on the basis of imitating and adapting to the laws of nature. Looking back at the history of ancient civilization in China, it is not difficult to see that people have left traces of imitating natural ecology earlier. From 3,000 BC, our ancestors, nestlings, mimicked birds in the trees, and the first wooden saw designed by Lu Ban in the Spring and Autumn Period and the Warring States to learn from the tooth-shaped edges of the grass leaves. The animal image and animal pattern are decorated with half-spotted pottery. A practical utensil that is based on various animal forms in real life, such as croissants, pig-shaped cups, and eagle-shaped pots. In the history of foreign civilization, there are also many cases of bionics. For example, Tyre was inspired by the shape of the fish's back bone and the shape of the snake's cheekbones. Da Vinci designed the most primitive human first aircraft and so on. A large number of examples describe people's creative imitation of the external form and function of natural life. Due to the special significance and role of bionics, people are now paying more and more attention to bionics. The birth of bionics has enabled the rapid development of human science and technology, which has enhanced people's understanding of the world and improved people's living standards. Bionics is not only widely used in human activities to conquer nature, but also in the creation of culture and art. Part of tennis is a model discipline that uses bionics.

2.2. Ant Colony Algorithm

Comparing the characteristics of the artificial ant system with the real ant system is helpful to understand the mechanism of the ant colony algorithm, and it also has certain reference significance for the improvement of the ant colony algorithm. Ant colony algorithm is derived from the biological phenomenon that the ant colony can find the shortest path between the nest and the food in the real world. The real ant system can also realize many other complicated functions. The ant colony algorithm only feeds on the ant colony. The abstraction and improvement of behavior, so there is a connection and difference between the two. Real ants rely on accumulating more and more pheromones on the shortest path to attract more ants along this path. Later ants will also release pheromones along the shortest path, further enhancing the attractiveness of the path. A so-called positive feedback mechanism has been formed. This mechanism is also borrowed from the ant colony algorithm. After the ant constructs the solution, it is evaluated by the mass function. The good solution is more strengthened, making it more attractive in the next iteration. The bad solution is The degree of reinforcement is weak or not strengthened, and gradually loses its appeal due to the volatilization of pheromones, the so-called positive feedback mechanism. The positive feedback mechanism is similar to the "snowball effect", and more and more ants are attracted to a certain path, which plays a crucial role in the convergence of the algorithm. However, pure positive feedback also has side effects. When the solution discovered by the ant is locally optimal, a large number of ants will be attracted to this path, hindering the discovery of a better solution, resulting in search stagnation. Both the artificial ant system and the real ant colony system have a negative feedback mechanism to balance the above positive feedback, which is mainly reflected in the ant's probability search technology.

The process of artificial ant optimization accepts the degradation of the solution to a certain extent, avoiding the premature convergence of the algorithm to the local optimal solution. It is through this random probability selection mechanism that real ants can find the shortest path from the nest to the food source during the intersection selection process. Ant colony algorithm is a kind of simulation of the foraging behavior of real ant colonies. It is a mechanism application, so it is not necessary to completely reproduce the real ant system. In order to improve the efficiency of the algorithm in the process of constructing the ant colony algorithm inspired by the real ant colony behavior, the artificial ant also has some characteristics that the real ant does not have. (1) Artificial ants exist in a discrete space, and their movement is a transition from one discrete state to another. The real ant is a continuous crawling behavior in the real three-dimensional world. (2) Artificial ants have an intrinsic state that memorizes their past behaviors, which provides convenience for solving constrained combinatorial optimization problems. Real ants do not show this ability. (3) The amount of pheromone released by artificial ants is a function of the degree of its solution. It exists in an environment that is not associated with time. Depending on the update strategy, there are many options for the timing of pheromone release. It can be released while moving, or it can be released after the construction of the solution. The amount of pheromone released by real ants is a fixed value, and it is a continuous process of moving and releasing. (4) In order to improve the optimization efficiency of the algorithm, some additional features can be added in the ant colony algorithm, such as increasing the heuristic factor related to the problem, adopting the local optimization strategy, and the fallback technique. Obviously, real ant systems are unlikely to have this type of feature.

2.3. Application of Animal Bionics in Tennis Training

In the practice of tennis tennis training, coaches and athletes not only need to master the training load intensity and load, but also need to understand the changes in body function after training.

However, the factors affecting the training load are multi-faceted. The single biochemical index has a certain limitation on the training load, so there will be some errors or limitations. For example, blood lactate can be used to assess training intensity, but it is impossible to understand the amount of training. Similarly, the use of blood urea to assess the amount of training, but can not understand the intensity of training. Some biochemical indicators are related to both the intensity of training and the amount of training. For example, when the amount of training is large, the amount of urinary protein excretion increases, but when the training intensity is increased, the amount of urinary protein is increased, and urine protein alone is used as an evaluation index, and both are difficult to determine. If other biochemical indicators are added, such as blood lactic acid, urine protein and blood. urea, the three indicators can be comprehensively assessed, the training load can be comprehensively assessed, and the athlete's response to the load can be objectively understood. Blood lactate is related to training intensity. Blood urea is related to the amount of training. Urine protein is related to training intensity, to training volume, and to physical function. At present, there are many biochemical indicators that can be actually used for testing. However, due to limitations of equipment and experimental conditions, the biochemical indicators that can be measured by the network team, combined with the relevant training and monitoring literature, and the relevant characteristics of the tennis project, Some of these indicators were identified as analytical indicators for the sports load model of tennis events.

Tennis is a game that consists of a large-scale intermittent, short-time, explosive force action during a long game time. Tennis is increasingly moving in the direction of strength and speed, and the requirements for physical fitness are high. With the increase of professional training years, the various functions of the body will change, and the adaptability to the load will also change. The athletes with short training years can bear less exercise than the athletes with longer training years, and the same amount of exercise, For young players it is possible to have a large exercise load. Therefore, professional training years can be used as an important factor in load forecasting, improving the accuracy of assessment capabilities. The blood index reflects the influence of the amount of exercise on the body function of the athlete during a period of time. It is suitable for monitoring the staged training. The urine index can reflect the physical function of the athlete in a short period of time. It can be sensitive and monitor the athlete's training situation in real time. Therefore, according to the equipment and experimental conditions of the national tennis team, the blood test data and urine test data are taken as different sample sets, which reflect the stage training and short-term training respectively. Because of the gender differences in some biochemical indicators, the test sample data of male and female athletes were classified and trained separately during training. Hecht-Nielson proved that a continuous function in any closed interval can be approximated by a hidden layer BP network. Therefore, this paper will adopt a three-layer BP network with an implicit layer, namely the r-n-1 neural network structure mode. Where n is the number of input nodes, r is the number of hidden nodes, and the number of output nodes is 1. The number of neurons in the input layer of the neural network is determined by the influencing factors. In this paper, the physiological and biochemical indicators and professional training years that can clearly reflect the physiological functions are taken as the influencing factors. Set the number of nodes in the output layer to 1, and the value range is [-1, 1]. As a quantized value to measure the load, the closer the value is to 1, the smaller the load, and vice versa. The role of the hidden layer node is to extract and store its intrinsic law from the sample. Each hidden layer node has several weights, and each weight is a parameter that enhances the network mapping capability. The number of hidden layer nodes is too small, and the information acquired by the network from the sample is poor. It is not enough to summarize and reflect the sample law of the training samples. The number of hidden nodes is too large, and the irregular content in the sample may be like noise. Also learn to remember, but reduce the generalization ability.

3. Experiments

3.1. Literature Method

The literature data method from the library, the sports college library, the Municipal Sports Bureau Tennis Management Center and other units through the computer search and through the China Journal Network to access relevant literature, carefully read the journals of the Institute of Physical Education in recent years, according to the needs of this paper writing, in China The online search for more than 70 articles on animal bionic sports tennis literature, and carried out effective sorting, analysis and refinement, and consulted some policy systems and some related documents issued by the State Sports General Administration on animal bionic sports tennis, such as Animal bionic sports tennis promotion and development regulations and some competition systems, etc., read a large number of related books, so that a deeper understanding of the history and development of animal bionic sports tennis, but also laid a solid theoretical basis for this article .

3.2. Questionnaire Method

The questionnaire survey method was designed to investigate the college athletes, coaches and managers who participated in college tennis tournaments, and to understand the development status of animal bionics in college tennis teams. The questionnaire tested the validity of the professional tennis experts and scholars through repeated investigations and revisions, and passed the review of the instructors. Finally, the questionnaire was designed to be "satisfactory, satisfactory, generally satisfactory, and less satisfied. Dissatisfied, "five qualitative indicators were evaluated, and a questionnaire validity evaluation of 150 people was conducted. 150 questionnaires were distributed and 150 copies were collected, and the recovery rate was 200%. As shown in Table 1, the questionnaires are valid in accordance with the research needs of this paper.

Table 1. Statistical table of validity results of questionnaires

	Satisfaction	More satisfied	Generally satisfied	Less satisfied	Not satisfied
Structural evaluation	27	15	23	12	1
Type evaluation	23	18	35	2	4
Content evaluation	41	27	25	7	5
Overall evaluation	21	23	19	9	9

To ensure the authenticity and reliability of the survey. After the first questionnaire has been collected and collected, the issuer will conduct a small-scale questionnaire test again 150 days later to test the reliability of the survey. On the 150th day after the questionnaire was completed, the questionnaire was sent to 150 students who were surveyed for questionnaires. After statistical calculation, the reliability coefficient is determined to be 0.86, and the reliability coefficient is higher than 0.8, so the reliability of the questionnaire is in line with the requirements of this research.

3.3. Experimental Method

Randomly selected 20 animal bionic tennis training students and 20 traditional tennis training students (not exposed to animal bionic tennis training), 20 animal bionic tennis training students to learn 21-time animal bionic tennis training techniques, test results, test animal bionics Tennis training results are A1. The experimenter was divided into two groups of training, the time was 21 weeks, and the athletes were trained on Monday, Wednesday, Friday and Sunday afternoon. The

training time was 45 minutes. The basic situation of the experiment comparison is shown in Table 2.

Table 2. Statistics of the basic situation of the experimental group and the control group (N=40)

	Experimental group (N=20)	Control group (N=20)	T value	P value
Age(years)	6.03±1.22	6.17±1.41	1.027	0.311
Sport level (level)	15.42±0.67	15.50±0.66	0.342	0.219
Training period (year)	2.75±0.452	2.67±0.432	1.012	0.399
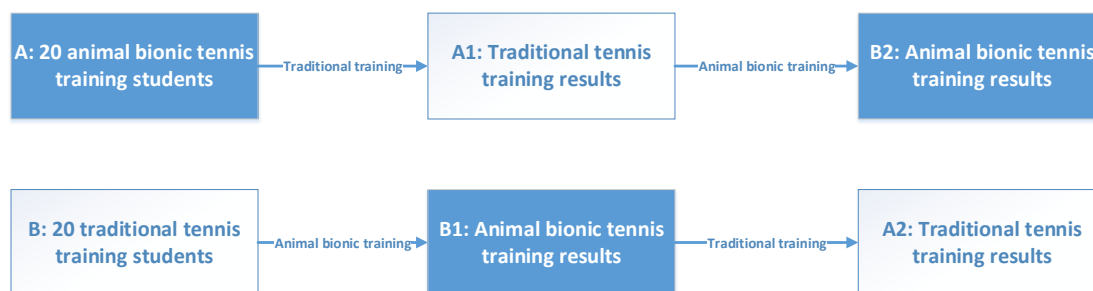
Figure 1. Experimental steps

Twenty traditional tennis training students learn 21-time tennis skills and test tennis scores. The test score is B1. 20 animal bionic tennis training students end 21 classes of animal bionic tennis training techniques after learning 21 hours of tennis skills learning, tennis performance test The test score is B2. Twenty traditional tennis training students ended the 21-hour tennis technique and took 21 lessons of animal bionic tennis training techniques to test the animal bionic tennis training results. The test score was A2. The two groups of students will be conducted under the same teaching schedule, the same teaching environment, the same teaching method and the same animal bionic tennis training teaching teacher. Try to avoid the interference and influence of unrelated factors on the experimental results, so that the experimental results are more accurate. More objective, more valuable, and more convincing.

4. Discussion

The morphological bionic form bionics refers to the simulation, deformation, transformation and other means of the animal's overall shape or a certain local feature, and is used in tennis training. The designed tennis training contains the animal's overall or a certain local morphological characteristics, and can be combined with the shape and use of the furniture, so that the tennis training can be vivid and more interesting. Compared with the traditional, single tennis training is more affected by the athletes. favorite. Want to improve the threat of forehand shots and reduce mistakes need to learn from the arc of hitting, tennis drop control, hitting power, tennis speed in animal bionic tennis training and tennis rotation, tennis The forehand shot effect is mainly reflected in the rotation of the tennis ball, the tennis ball speed and the tennis drop control ability. After being guided by the tennis senior coach, it is difficult to control the rotation angle and speed of the tennis ball when the animal bionic tennis training athlete is hitting the ball for the forehand. Do a simple upswing or downspin. Combining the basic principles of forehand hitting, the tennis forehand hitting effect, the interview content of the tennis senior coaches and the factors of the forehand hitting ability of the animal bionic tennis training athletes at the present stage, the animal bionic tennis training athletes are finally determined. The forehand hitting speed and the tennis drop control ability are used as evaluation criteria to judge the pros and cons of the tennis player's
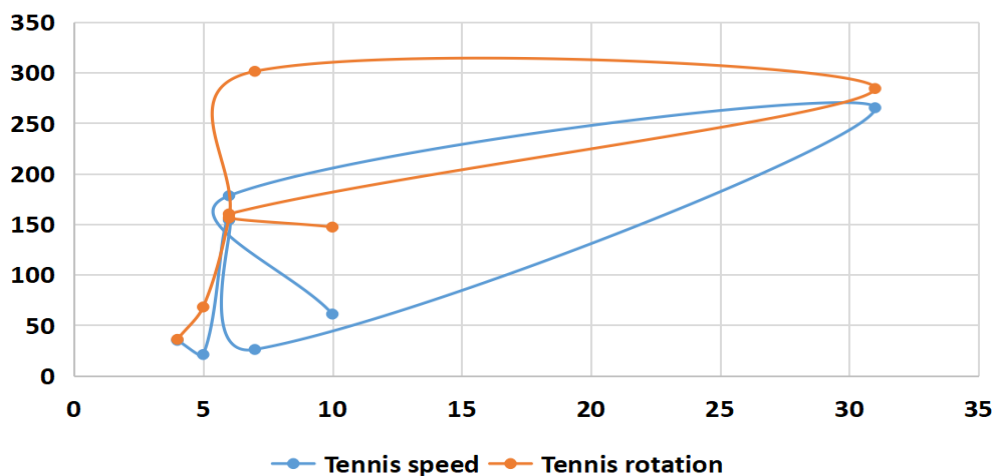
forehand shot. as shown in Figure 2.

Figure 2. Comparison of tennis speed training

Although the animals on the earth have different living and playing skills, there are many movements of the limbs and survival skills of humans and animals. From biology, "the hand is part of the front end of the human or other primate arm, and the person uses the upper end of the upper limb of the tool." The hand is made up of the palm and five fingers, and the purpose is mainly to "grab" and "hold" things. Conduct activities to maintain improved living conditions. The hand is one of the important organs that can make people highly intelligent. The most fundamental difference between humans and animals is that in nature, people make and use tools by hand, and animals do not. The dexterity and cleverness of the human hand is unique. Animals can use their fingers freely, but the claws of animals are not flexible enough. Only humans will use their own hands to labor and make tools. The animal's athletic ability is shown in Figure 3.

Figure 3. Animal's athletic ability

Only human fingers can do all kinds of tricks. This unique skill is the most fundamental reason for human culture and technological progress. The hand is the most useful organ for human labor, and the use of hand to express the language of tennis training in tennis training has become a top priority. Before and after the experiment, the experimental results may be affected by the difference in upper and lower limb strength. The upper and lower limb strength tests before and after the experiment can effectively monitor the changes of limb strength and reduce the experimental error. Second, the core strength is not only the "power source", but also the transmitter, the enhancement of the core strength, can enhance the power transmitted to the limbs, thereby improving the forehand effect of tennis players. The core strength test of the tennis training exercise is shown in Table 3.

Table 3. Six-level abdominal bridge test scoring criteria

Test level	Duration	Grade score	Specific requirements
First level	60s	1	With both legs and elbow support, the body is straight
Second level	15s	3	Left elbow and foot support, the body is straight
Third level	15s	6	Right elbow and foot support, the body is straight
Fourth level	15s	6	Double elbow left foot support, body straight
Fifth level	15s	10	Double elbows and right foot support, the body is straight
Sixth level	15s	15	Left elbow and right foot support, the body is straight

According to the analysis of the quality test data of the experimental group and the control group tennis players before the experiment, it is known that the experimental group and the control group have a paired sample test before the experiment, and there is no significant difference in $P>0.05$. The experimental data meet the requirements of this experiment. The experimental results are shown in Figure 4.
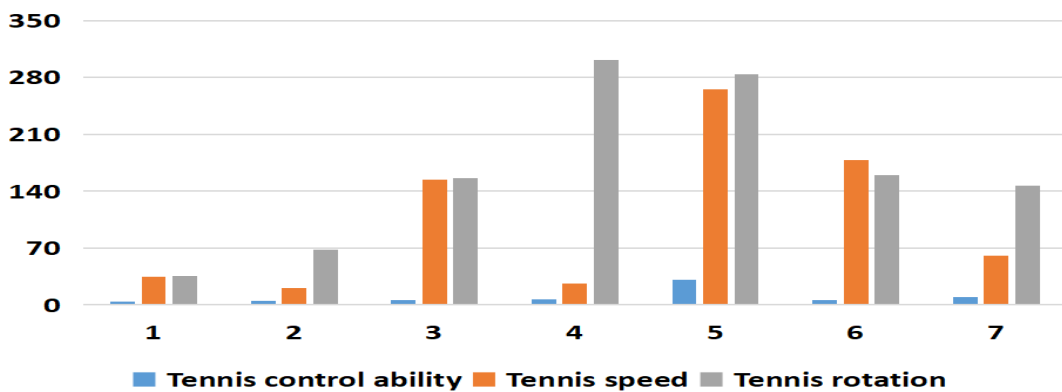

Figure 4. Comparison of the scores of the six-level abdominal bridge

The test scoring criteria are shown in Figure 5. The tester sends the ball and scores 2 points between the A baseline and the doubles serve line. The drop point falls on the line of the doubles after the doubles, and $0 <L \leqslant 20$ cm scores 1.5 points. The drop point is scored 1 point in the front of the C doubles after the 20#L≤50 cm. The drop point is 0.5 points after L>50 cm before the D-doubles serve line. The wrong area, out of bounds, and the next network do not score. A total of 10 scores are test scores.
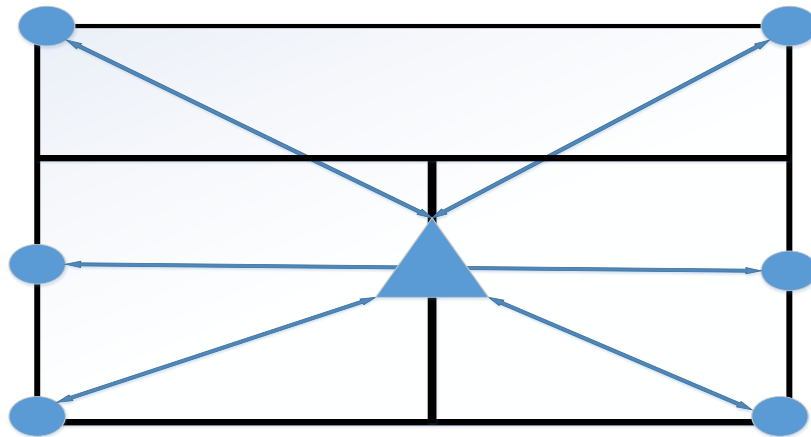

Figure 5. Schematic diagram of the tennis training moving step score standard

Through the statistical analysis of the scores of the bionic tennis footwork and the unfamiliar

animal bionic tennis footwork technique, the average score of the students who have studied the animal bionic tennis walking step is 16.89. The average score of the students in the test was 19.63. The difference between the two groups was 2.73, P=0.004<0.05, indicating a significant difference between the two groups. The average score of the technical evaluation of the tennis moving step method of the students who have studied the animal bionic tennis moving foot method is 8.30, and the average technical score of the tennis moving step method of the students who have not studied the tennis moving step is 7.80. The difference between the two groups is 0.45, P=0.033<0.05, indicating a significant difference between the two groups.

5. Conclusion

This paper conducts research on bionic elements in tennis training. Firstly, it expounds the research content and value of bionics, and explores the indissoluble bond between the origin and development of bionics and tennis training, and from the aspects of tennis training form and tennis training field. Analyzed the application of bionic elements in tennis training. The main conclusions are as follows.

(1) In the animal bionic tennis training, the ball speed, angle and rotation vary. There are many kinds of game forms and types of sports games that match the characteristics of tennis. In the training, the combination of multiple balls and games can be based on each. The focus of the class exercises is to make reasonable arrangements. Integrating the athlete's physical fitness training into multi-ball training and sports games, on the one hand, it can optimize the athlete's hand, foot movement and body comprehensive ability to meet the high-intensity requirements of the tennis match, so that the athletes can establish Self-confidence on the body lays a solid foundation for the continuous improvement of training.

(2) On the other hand, it can alleviate and restore the physical fatigue of athletes due to training, improve the quality and effectiveness of follow-up training, and play a positive role in the long-term and stable improvement of athletes' physical fitness. In tennis training, teachers should optimize and improve tennis teaching methods and teaching methods, reasonably arrange teaching content, formulate scientific teaching plans, and strive to improve teaching efficiency.

(3) In the teaching process, we should constantly innovate teaching methods, adopt novel teaching methods, including various warm-up exercises and interesting special games, and also cultivate students' mutual cooperation awareness and improve students' cooperation ability. Let students continue to learn and improve in cooperation. Teachers should also allocate the exercise time reasonably and arrange the amount of exercise reasonably to ensure that the students can fully mobilize the body functions, and at the same time, the amount of exercise should not be too large, resulting in sports injuries.

Data Availability

Data sharing is not applicable to this article as no new data were created or analysed in this study.

Conflict of Interest

The author states that this article has no conflict of interest.

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