Computer Aided System for Swimming Teaching and Training

Han Guo(✉)

Northwestern Polytechnical University (NPU), Xi'an 710072, China
johnson0730@nwpu.edu.cn

Abstract. In the field of sports, the successful application of computer-aided system in various sports has been paid more and more attention by PE teachers and coaches. We know that the computer-aided system involved in the field of physical education and training, not only will improve the scientific training teaching to a new stage, but also bring the rapid improvement of the level of competitive sports. The application of high-tech achievements in sports training and teaching is the development direction of modern sports teaching and training. The emergence of computer-aided system technology provides a strong driving force for swimming teaching and training to a faster and better level. This paper expounds the composition and characteristics of the computer-aided swimming teaching system and the particularity of swimming teaching and training. This paper discusses the feasibility of the application of computer aided system in swimming teaching and training.

Keywords: Computer aided system · Swimming teaching · Swimming training · Application · Feasibility

1 Introduction

With the rapid development of computer technology, its application has penetrated into all fields of society, which has effectively promoted the development of social informatization. Mastering and using computer technology has become an essential skill for people. In recent 10 years, it has been widely used in aerospace machinery design, computer simulation and so on. With the increasingly fierce sports competition and the continuous improvement of sports training level, high-tech means are more and more widely used in sports competition and training teaching. However, the computer aided system (CAS) has not been developed in the field of sports due to technical personnel, funds, design difficulties and other reasons. We know that the intervention of high technology in the field of sports teaching and training not only improves the scientific training teaching to a new stage, but also brings about the rapid improvement of competitive sports level. It is the development direction of modern physical education teaching and training to seize the opportunity to apply high-tech achievements to sports training and physical education teaching [1]. With the development of sports teaching and the continuous

M. A. Jan and F. Khan (Eds.): BigIoT-EDU 2021, LNICST 391, pp. 43–52, 2021.
https://doi.org/10.1007/978-3-030-87900-6_6

improvement of sports training level, the deepening of specialization forces athletes and coaches to constantly improve and improve sports technology, training methods and with the help of high-tech equipment to adapt to the fierce competition of high-level competitions. It also makes PE teachers use high-tech means to improve the quality of physical education, and provides new methods and ideas. Therefore, the application of computer-aided system in swimming teaching and training has a very broad prospect and great significance.

2 Computer Aided Diagnosis Method Based on Random Forest

Image graying is to convert color images into images with pixel values between 0 and 25, that is, to convert them into images with different gray levels, so as to reduce the interference of color on the final imaging of national standard tumors. At present, there are kinds of image graying methods.

Component method:

$$Gray = B; Gray = G; Gray = R \tag{1}$$

Where gray is the gray value of the converted gray image. R. G and B are the three parts of color map.

Maximum method:

$$Gray = \max(B + G + R) \tag{2}$$

Image smoothing is to remove the noise in the image and improve the definition. In this study, wavelet de-noising method is selected for image flattening. Firstly, the image signal is decomposed by wavelet, and then the decomposition result is quantized by threshold [2–4]. Finally, the image signal is reconstructed by using two-dimensional wavelet to obtain the denoised image.

3 Application of Computer Aided System in Swimming Teaching and Training

3.1 Composition and Concept of Computer Aided System

3.1.1 Computer Aided System Includes

Computer aided design (CAD), computer aided manufacturing (CAM) and computer base education (CBE) are mainly used in swimming training. In As shown Fig. 1 and Fig. 2.

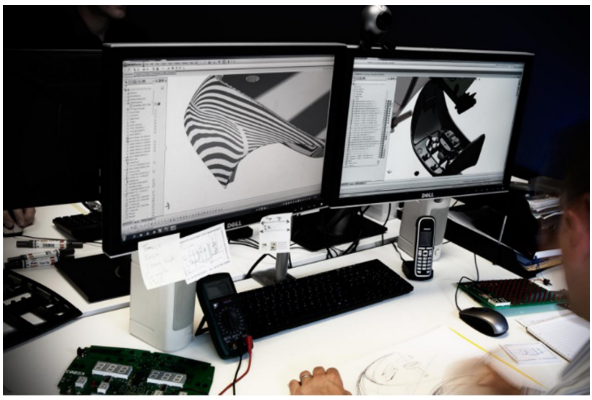

Fig. 1. Computer aided design

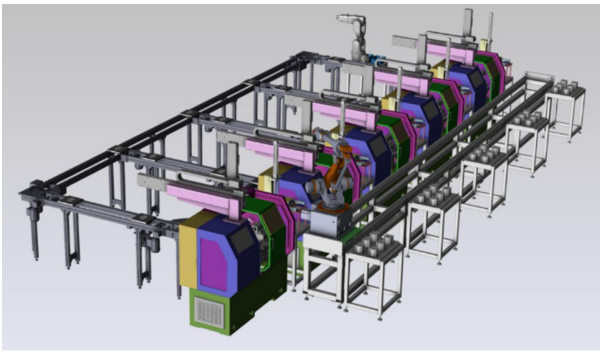

Fig. 2. Computer aided manufacturing

3.1.2 Computer Aided Design

Computer aided design (CAD) is to help all kinds of designers design with computers. Because the computer has the ability of fast numerical calculation, strong data processing and simulation, CAD technology has been widely used. For example: the innovative design of swimming techniques, the quantitative analysis of the world's elite swimmers' techniques. As shown in Fig. 3. The adoption of CAD not only improves the speed of technological innovation, but also improves the innovation quality and mastering speed.

3.1.3 Computer Aided Education

Computer Aided Education (be) includes CAI (Computer Assisted Instruction), computer aided test (CAT) and computer management (CML). Computer aided instruction (CA) is a kind of teaching method that uses computer as teaching medium to teach learners. It makes great changes in teaching mode, teaching content, means and methods of educators [5]. The situation of teachers in class (one person, one pen, one brush) has gradually become history. With the popularity of computers, CA has gradually become

Fig. 3. Computer base education

an important means of teaching. There are three kinds of Ca: network Ca, multimedia Ca and intelligent ca [3]. With the development of computer and network technology, cat and °C m are used for teaching management (exchange and transmission of teaching documents, test papers, etc.) and examinations.

3.2 Hardware Equipment for Computer Aided System

Host computer (PC, PC workstation), graphics and image processing system (input device and output device). hardware equipment required by cal (see Fig. 4). The hardware environment required by CBE is the same as above.

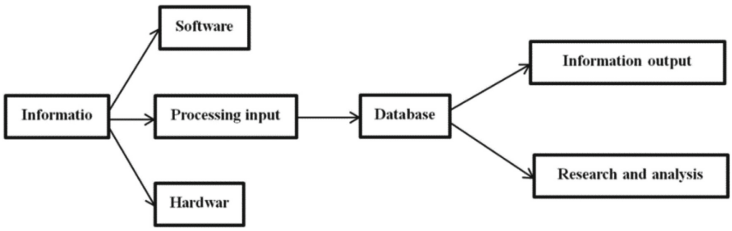

Fig. 4. Hardware equipment required by computer aided system

4 The Importance of Core Strength Training in Swimming Teaching and Training

4.1 The Meaning of Core Strength Training

The middle part of the human body is called the core, which is the muscles around the abdomen and buttocks. Collectively referred to as the “core muscle group”, it is the main

part of the whole body. It mainly includes abdominal muscles, hip muscles, and muscles connected with spine and bone box. The training of these muscle groups is called core strength training. Core strength plays a stabilizing and supporting role in motor skills and special technical movements, including posture. Therefore, the core strength is unstable, which has a great negative impact on people's mastery of the body, including posture. Before formally organizing the students to swim, the teacher must lead them to make preparations, so as to help them overcome the fear of water and lay a good foundation for the cultivation of water sense [6–8]. First of all, before swimming training, teachers should carefully combine the actual situation of students and the goal of water sense training, seriously formulate swimming training plan, and pay attention to organizing students to participate in preparatory activities before training. In this process, the teacher can directly teach the relevant theory to the students, use vivid language to describe the swimming process and visually demonstrate the specific action, so as to enhance the students' experience of water sense cultivation. For example, teachers can describe the state of a person swimming in the water as "floating objects in the water" and guide them to imagine the feeling of floating in the water.

4.2 The Necessity of Core Strength Training in Swimming Training

The muscle tissue of sex people can be divided into two types: superficial muscle and deep muscle. The superficial muscle is mainly responsible for strength and outburst, and the deep muscle is mainly responsible for stabilizing the body. The core muscle group can be divided into two parts: large core muscle group and small core muscle group. For these two parts, the core muscles are the superficial muscles, such as the extraabdominal muscles. The core small muscle group is the deep muscle, which plays a stabilizing role and plays a very important role in the body's trunk fixation. For example, the core strength training of internal abdominal muscles is the foundation of other sports training. A strong core muscle group can help us effectively improve our sports ability and efficiency. When upper and lower limbs are moving and exerting, the core muscles play a very important role in connecting the preceding and the following, helping us stabilize the body's center of gravity [9–11]. Therefore, when we swim and swing our arms and thighs, the core muscle group will help us better mobilize the muscles of the whole body, provide a support point for other parts of the force, reduce physical energy consumption, enhance sports ability, and improve sports efficiency. Scientific research results show that if swimmers want to improve their sports ability, they must strengthen the training of core strength. The core strength can mobilize the muscles of the whole body, maintain coordination, make the muscles combine with the nervous system in a relaxed state, instantly concentrate the strength, produce a huge resultant force, increase the swimming speed, reduce the resistance, and improve the performance.

5 Methods of Cycle Training

5.1 Using Statistical Software for Mathematical Statistics

Mathematical statistics method needs to be based on certain data. Two classes can be selected as experimental classes, and then the teaching experiment time of the two classes

is controlled at 14 weeks. Before the cycle training experiment, the students' physical fitness, learning interest in swimming and swimming achievement are tested. After the experiment, these data are tested repeatedly to compare the two groups of data, All the data will be included in the statistical software for mathematical statistics, in order to test the practical role of cycle training method in swimming teaching.

5.2 Teaching Experiment Method

The traditional teaching method is used in the control class, that is, according to the swimming syllabus, the teaching plan is made, the breaststroke techniques are explained to the students in order and step by step, and then the corresponding training is carried out. The experimental class uses the circular training method to carry out the swimming teaching, that is, the teaching content of each class is divided into several parts, fixed multiple areas and swimming lanes to complete different parts of the training, and each swimming lane is set with different training time [12]. At the end of the training time, the students of each lane change their positions and continue to complete the corresponding part of the training after a short rest. The amount of training and training hours of the experimental class and the control class are completely consistent. The experimental class only set up four task sites (kicking, rowing, variable speed swimming, cooperative swimming) in each class, so as not to affect the efficiency and quality of students due to too many task sites.

6 Application of Cycle Training Method in Swimming Teaching in Colleges and Universities

6.1 Improve the Physical Quality of Students

Through the study of the data, it is found that after applying the circular training method to the swimming teaching in Colleges and universities, the physical quality of the students has changed significantly, mainly in the obvious changes of the trainer's ketchup index and skinfold thickness [13–15]. At the same time, the resting heart rate and vital capacity of the trainers have also been enhanced to a certain extent, The fat content of the trainers decreased in different degrees, so the swimming teaching under the circular training method can effectively improve the physical quality of the students.

6.2 It Improves the Interest of College Students in Swimming

Before and after the experimental teaching, the scores of students' learning interest test in the experimental class were (80.95 ± 485) and (90.57 ± 3.01) respectively, and those in the control class were (8152 ± 498) and (80.31 ± 3.95) respectively. From these data, we can see that the two classes are interested in swimming before the experiment, and the level of interest in swimming of the two classes is similar. After the experiment, the score of learning interest of the experimental class is significantly improved, which shows that the circular training method can effectively stimulate students' interest in swimming, which may be related to the different training content and training focus of each task site under the circular training method, which can give students more freshness and maintain a high degree of enthusiasm for swimming.

6.3 It Is Helpful to Relieve Students' Fatigue in the Process of Swimming

No matter in which sport, there will be different degrees of fatigue in the process of exercise, so in swimming, the trainer will also have a sense of fatigue. However, sports injury does great harm to the trainer's body, which will not only damage the trainer's body, but also affect the subsequent normal training of the trainer. Through the experiment, it is proved that when the reasonable cycle training method is used in swimming teaching, it can obviously reduce the fatigue of the trainers. This is mainly because the cycle training method can effectively divide the repeated training tasks into several simple and easy to complete small projects, and the students will not have too much exercise pressure during the training, reducing the probability of sports injury.

6.4 It Effectively Improves the Students' Swimming Performance

Because the circular training method divides the whole training into several small tasks, it enables students to train every swimming skill accurately [16]. Therefore, the circular training method is conducive to the comprehensive training of swimming skills, which is more conducive to students to master the basic skills of swimming, and can train leg muscles and increase arm training separately, So that students can fundamentally improve their swimming speed, and then improve their swimming performance.

7 Application of Computer Aided System in Swimming Teaching and Training

7.1 Application of CAD in Swimming Training

With the improvement of the level of competition, the athletes and coaches put forward higher requirements in the design of technical movements and learning advanced technology.

If athletes can absorb foreign advanced technology, learn from each other, and then form a set of their own near perfect technology according to their own characteristics, is the key factor to win the competition. In swimming training, the training and innovative design of action technology is still in the stage of artificial design mainly based on experience, only relying on the coach's language to explain and demonstrate, the athletes try carefully. This has many disadvantages, such as long design and training cycle, low efficiency, poor quality, narrow creative source, and can not simulate and demonstrate new movements unless the athletes train in person. So we can use CAD technology in the following two aspects.

7.2 Application of CAA in Swimming Training

The parameters of each part of the body are input into the computer to establish a set of human body model database. It can automatically simulate all kinds of swimming movements, and use computational virtual technology to establish site models and particle system models that are consistent with the real environment to replace flume experiments, so as to help people study hydrodynamic problems such as water resistance

change and influence. Biomechanical analysis computer has many advantages, such as large data processing, accurate and rapid calculation, and no human error. Therefore, the prospect of introducing CAA technology into the field of swimming is very broad. For example, the United States power company has applied CAA technology to swimming. Its powerscan portable swimming technology analyzer can be used for biomechanical analysis of the whole race, average speed and instantaneous speed [17–19]. As shown in Fig. 5. A series of technical analysis, such as stroke frequency, stroke start, take-off, turn, sprint calculation and hand in angle, stroke angle and so on. Because powerscan instrument is compact and convenient, it is helpful to analyze and improve swimmer's technique.

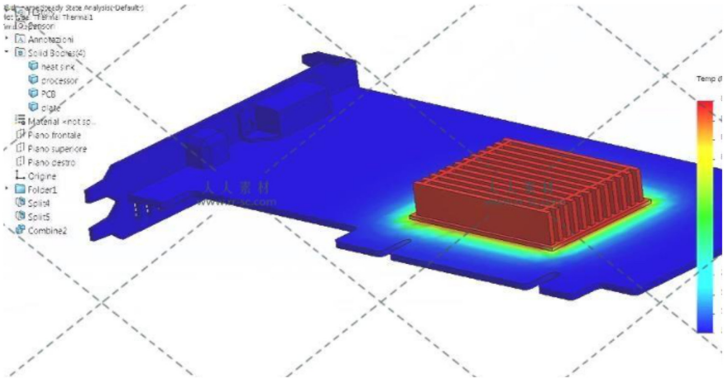

Fig. 5. Application of CAA in swimming training

7.3 Application of Computer Aided System in Swimming Teaching

In recent years, the development of network technology and multimedia technology has promoted the development of CBE. Online teaching and distance education have been carried out in many schools. The development of CBE makes great changes in teaching activities and teaching quality. In the field of swimming, the development of CBE provides an opportunity for sports colleges and other sports personnel training units to cultivate all-round development of high-quality swimming talents. The application of Ca in swimming teaching CA breaks away from the traditional teaching mode of human, pen and board, and introduces sound, light and image into teaching, which is intuitive and easy to understand. At the same time, CA teaching can solve the problems of improving teaching efficiency, lack of teaching staff and teaching standardization. In this regard, some researchers in China have achieved some research results [20]. For example, Zhang Zhaohui of Guangzhou Institute of physical education and Lu Peng of PLA Physical Education Institute have applied several kinds of swimming teaching CA courseware to swimming teaching activities, which has played a very good teaching effect and response.

7.4 Application of Cat in Swimming Teaching

Cat is a revolution of education examination in recent years. one side. It input examination Resources into λ database, and then randomly select test papers according to the difficulty for ability assessment. It realizes the test form of "test paper marking scoring automation". Can correctly and effectively determine the objective multiple choice questions [4]. On the other hand, with the development of CA technology in recent years, the research on the computerization of subjective examination papers has also appeared. For example, ETS has designed a set of CAT system combining GRE and GMAT composition examination, which implements double computer marking. That is to say, two computers simultaneously judge a composition paper. If the difference between the two computer scoring results is more than one point, manual marking is used [21–24]. After using the system, the marking time of GRE and GMAT compositions has increased from 30 min to 5 min. It has greatly improved the efficiency of examination scoring. Therefore, CAT technology for us in swimming teaching examination, referee examination or other content of the examination to create a new idea.

8 Conclusion

It is of great significance to apply CAS to swimming teaching and training. At present, there are many difficulties in the application of CAS in swimming training teaching, especially in the research of technical simulation. Using CAS to improve the level of swimming teaching and training is ultimately the improvement of people. With the continuous development of computer technology and related disciplines, computer aided design (CAS) will become an important force in swimming teaching and training. Intellectualization and precision will be the research direction of this kind of subject in the future. In many sports training methods, the circulation training method is a more common training method. The research shows that the correct cycle training method can not only have a very beneficial effect on the body's organ blindness, but also improve the athletes' training endurance and strengthen their muscle strength to a certain extent. Based on the swimming teaching in Colleges and universities, this paper compares the traditional training method with the circular training method, and discusses how to better apply the circular training method to the swimming teaching in Colleges and universities, so as to achieve the purpose of improving students' interest in swimming through the correct circular training method.

References

1. Yongsheng, W.: Feasibility study on the application of computer aided design in sports competitive action. J. Beijing Sport Univ. **2** (1998)
2. Qing, W.: Thoughts on sports science and technology. In: Proceedings of Scientific Research Institute of General Administration of sport of China (2000)
3. University Computer Committee. Basic Computer Knowledge. Beijing, Higher Education Press (2000)
4. Riewald, S.: Biomechanical simulation of hand and arm propulsion. Swim. Inf. **4** (2001)

5. Xinqi, L.: Research on the application of imagery training in swimming teaching in colleges and universities. Phys. Educ. Teach. Friends **44**(1), 41–44 (2021)
6. Lin, Z.: Swimming training "bravery" in the first place: exploration on the mode of psychological training in swimming course. Sports Sci. Technol. Lit. Bull. **29**(1), 82–124 (2021)
7. Xiufeng, H., Qiaoqin, W.: Research on the content and method of physical training in college swimming teaching. Youth Sports **12**, 87–89 (2020)
8. Fei, X.: Analysis of core strength training in swimming teaching and training. Sci. Technol. Inf. **18**(34), 240–242 (2020)
9. Gengyi, H.: Research on core strength training in swimming teaching in colleges and universities. Ice Snow Sports Innov. Res.
10. Xiaodan, Y.: Analysis of core strength training methods in swimming teaching and training. Farm Staff **18**, 261 (2020)
11. Lin, N.: Scientific research on swimming teaching and training methods in military academies. Contemp. Sports Sci. Technol. **10**(26), 72–73 + 76 (2020)
12. Jing, P.: Research on the application of core stable strength training in swimming teaching in colleges and universities. Res. Innov. Ice Snow Sports **13**, 27–28 (2020)
13. Cheng, Y.: The causes of "fear of water" in children's swimming teaching and the ways to overcome it. Contemp. Sports Sci. Technol. **10**(18), 204–206 (2020)
14. Zixuan, Z.: Analysis of core strength training in swimming teaching and training. Chin. New Commun. **22**(12), 194 (2020)
15. Bodong, Z.: Discussion on the practical application of circular training method in swimming training in colleges and universities. Res. Innov. Ice Snow Sports **10**, 59–60 (2020)
16. Ruilin, D.: Problems and countermeasures of training beginners in swimming teaching. Rural Staff **10**, 296 (2020)
17. Lei, W.: Research on the application of imagery training in freestyle teaching for students aged, pp. 10–14. Harbin Normal University (2020)
18. Xiaochen, J.: Optimization design and empirical research on the teaching of elementary breaststroke kick technique for boys aged, pp. 11–12. Capital Institute of Physical Education (2020)
19. Xinyu, H.: Experimental study on the effect of physical training on children's swimming teaching. Southwest University (2020)
20. Wei, W.: Research on the application of modern information technology in swimming training. Contemp. Sports Sci. Technol. **10**(11), 53–54 (2020)
21. Qian, Z.: Experimental study on the effect of gradual relaxation training method on swimming beginners' fear of water. Southwest University (2020)
22. Fangke, L.: Discussion on core strength training in swimming teaching and training. Contemp. Sports Sci. Technol. **10**(10), 63–65
23. Yuzhe, W.: Analysis of core strength training in swimming teaching and training. Sports Prod. **39**(3), 77–78 (2020)
24. Zhe, L.: Research on the influence of swimming teaching on the physical coordination ability of children aged, pp. 6–8. Shandong Institute of Physical Education (2020)