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Basketball Teaching Target Flight Path Based on Image Recognition

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Abstract Basketball teaching is an important part of school physical education (PE) curriculum. It is welcomed and loved by many students. When choosing sports, they are always popular with students. However, with the development of education and the change of the situation, basketball teaching has become more and more complex and inefficient. In the era of rapid development of the Internet, teachers should fully understand and apply the network. This text first analyzed the theoretical basis of the goal of basketball education, and explained the importance of implementing quality education in teaching and paying attention to the cultivation of students' innovation ability. This text proposed that the orientation of basketball education goals should be based on PE. Then this text analyzed the current basketball curriculum teaching and basketball track image information. It focused on the analysis of three problems: the limitation of teaching content, the lack of optimization and expansion, the limitation of basketball teaching, the lack of extension in the class, and the lack of basketball movement track image information. It pointed out that these problems seriously affect the development of current basketball teaching, and these problems should be solved in time. Then this text proposed to use image video sequence analysis algorithm to strengthen basketball flight path analysis, and proposed the positive value and basic principles of image recognition technology (IRT) in college basketball teaching. This text proposed to improve the application of IRT in basketball flight trajectory, create diversified curriculum content based on IRT and innovate basketball teaching methods based on IRT. Finally, this text combined image and video sequence analysis algorithm with experimental investigation and analysis. According to the experiment and investigation, the image video sequence analysis algorithm was introduced into the construction of basketball trajectory image information. A new image information system of basketball movement track was designed, which can improve the detection efficiency of basketball flight path analysis by 25.8%.

Index Terms Basketball Teaching Goal, Target Flight Path, Image Recognition, IoT Application

I. Introduction

With the economic development and social progress, people's cognitive ability has been greatly improved. With people's attention to physical health and spiritual life, sports are also getting more and more attention. Basketball has become a popular sport in China with its unique advantages. Basketball has attracted the attention of society, especially schools. Basketball is an important part of school sports and plays an important role in their growth.

Basketball teaching is to understand the origin of basketball, know some simple basketball rules, and make students interested in basketball. Kzar Mazin Hadi has drawn some conclusions about the effect of educational digital training exercises based on metacognitive skills in the teaching of basketball offensive skills. In the application exercise of metacognition education used in the education curriculum, the experimental group's preference for the experimental group has played an effective role [1]. Chen Wengang discussed the practical application of network multimedia courseware in school basketball teaching [2]. Digelidis N examined the relationship between coaches and transformational leaders. Among the teams that reported higher than average coaches, the athletes who reported higher than average coaches reported the greatest development. The research results clarify the transition coach behavior related to the positive experience in youth sports [3]. Koh Koon Teck believed that ICT can enable educators to develop innovative, environment related approaches to provide a better learning experience. He investigated the pre-service PE teachers' cognition of flipped learning basketball curriculum in the PE teacher education project [4]. Latinjak Alexander T studied how goal oriented self dialogue helps basketball players adjust themselves in a rigid competitive environment. The research results show that the athlete's self dialogue may help to meet the psychological needs in each situation [5]. Zhang Ning found that the new trend of school education is characterized by long-term learning, which means that PE and sports science must be strengthened [6]. Kolovelonis Athanasios investigated the influence of autonomous learning teaching units

on students' PE achievement calibration, goal achievement and attribution. The results are related to the calibration and autonomous learning in PE teaching, and also provide the practical significance and direction of future research [7]. These researches have fully elaborated the basketball teaching goal, but they were not related to the flight path of the basketball teaching goal.

Shooting is the key to basketball scoring. Combining basketball track tracking and image processing technology can improve the accuracy of basketball shooting. Zhang Shaoliang used interdisciplinary methods to evaluate the competitive ability and deliberate practice of young basketball players, and continued to participate in the structured basketball training program [8]. Liu Ning aimed to study goal recognition methods based on intelligent analysis of real-time basketball images of the Internet of Things (IoT), so as to accelerate the development of basketball and other sports fields [9]. The purpose of Arede Jorge's research is to investigate the medium-term impact of early experience in sports development on the physical fitness of talented basketball players under the age of 13, and determine the variables that distinguish the selection of national team training camps under the age of 14 [10]. DeLand Michael F has developed a sensor based wearable device, and this research proposed a system. The system can use an algorithm called dynamic time warping to identify basketball referee violation signals. The system can identify or identify which basketball violation is executed through the data set provided by the user [11]. Ramos Sergio compared the maturity, shape and fitness attributes of young basketball players in elite basketball colleges. It is suggested that coaches avoid identifying talents too early and provide opportunities for players to improve through talents [12]. Stojanovic Emilija studied the reliability, usefulness and factor validity of the direction change speed test for young basketball players [13]. Hu Xinyao proposed a basketball activity classification model based on dynamic time warping and body kinematics measurement. The model can achieve classification accuracy. The results of this study support the feasibility of real-time sports activity classification, and provide insights into the best sensor location for basketball activity classification applications [14]. These researches have fully elaborated the flight path of basketball teaching objectives, but they were not related to basketball teaching objectives.

The application of IRT in students' basketball technology teaching can optimize teachers' teaching efficiency and enable teachers to make full use of students to optimize classroom teaching objectives. It encourages students to actively participate in learning and adopt feedback teaching methods in a timely manner. The effectiveness of IRT in basketball training is incomparable among traditional training methods. It can help students develop their thinking, explore new goals and improve teaching efficiency and quality.

II. Theoretical Basis for Basketball Education Objectives

(1) Implementing quality education in teaching

At present, considering the long-term development of society and education, countries can incorporate quality education into their national education policies. The main goal of quality education is to cultivate the basic quality of students so that they can develop in an all-round way in the learning process. With the deepening of educational reform, PE is an important task of education, and basketball teaching plays an important role in PE. In recent years, basketball is very popular among students. Basketball education not only improves students' physical quality, but also enables them to learn the theoretical knowledge of basketball. It can deepen the understanding of basketball, and cultivate excellent team quality, organizational discipline and team motivation play an important role in cultivating students' quality, emotion and behavior. Basketball education is an important way to carry out quality education, aiming to cultivate high-quality talents and meet the needs of social development. Basketball education is an important way to carry out quality education, aiming to cultivate high-quality talents and meet the needs of social development. Basketball education cannot be simply regarded as a kind of sports, but must be based on sports to improve the overall physical and mental quality of students. It inspires students' interest in basketball teaching and rethink basketball training courses. Having good interest is a positive psychological state and an ideal psychological state. However, because of the blind explanation, demonstration and practice of sports, students are tired of learning, tired of competition and lack of interest in basketball. Only by implementing interest education can we effectively reverse this adverse situation and achieve real quality education of basketball.

(2) Pay attention to the cultivation of students' innovation ability

The most important competition in the world today is the competition for talents. The talent centered training model is crucial to strengthening the overall strength of the country. The main purpose of education is to cultivate people. Therefore, the current choice of educational goals must fully consider the development of human beings and society. Society is human society, social development is human development, and national progress is human progress in the final analysis. Therefore, human development is ultimately the development of the country, society and education. In the learning process, one should must release the students' internal potential, strengthen their

ability, cultivate their ability to innovate constantly, and improve their social competitiveness, as displayed in Figure 1. The purpose of PE is to cultivate students' sports knowledge and skills and improve their physical quality.

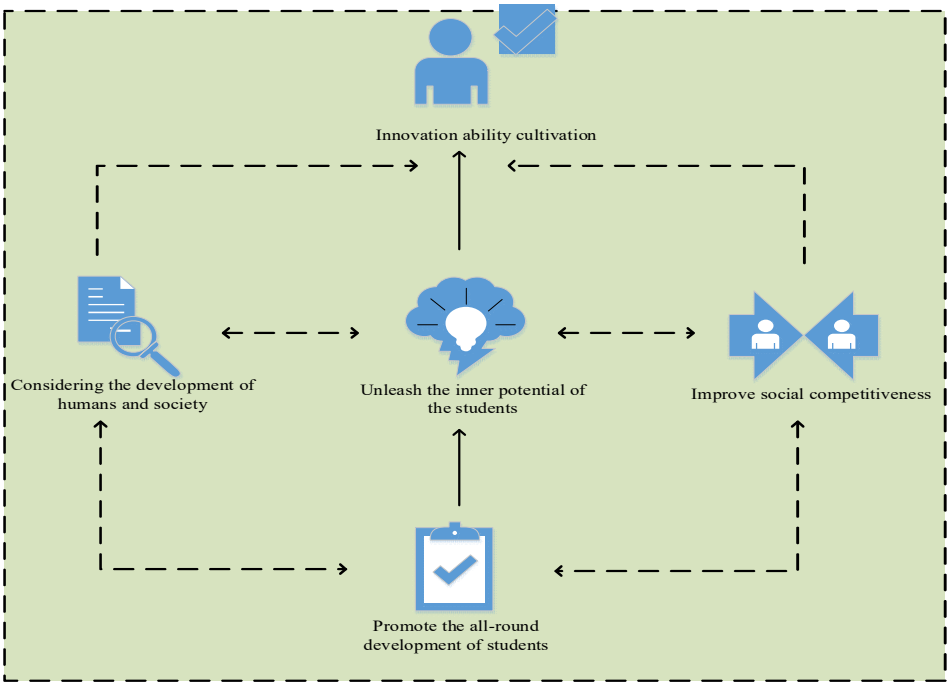

Figure 1: Pay attention to the cultivation of students' innovation ability

III. Problems in Current Basketball Course Teaching and Basketball Track Image Information

(1) Limitation of teaching content and lack of optimization and expansion

Basketball, as a popular mass sport in the world, is developing constantly. Basketball training should pay attention to the reasonable renewal of training content. From the current actual situation, the content of school basketball teaching is relatively limited, staying in the most basic basketball technology, such as passing, shooting and other fields, and the development of basketball history, basketball league, technology and tactics is not enough. In addition to the learning content, learning methods are also the key factors that affect the learning effect. In the current basketball teaching, many teachers adopt a unified teaching method, that is, a fixed course of explanation, demonstration and practice. Under this fixed mode, students' interest in learning is gradually reduced, and even there is resistance to classroom teaching. Students just want to play basketball freely. They are not serious in learning, and they are often passive in learning.

(2) Basketball teaching limitation, lack of extension in class

The basketball lesson is divided into two parts: teachers' teaching and students' learning. It is not difficult to teach and explain basketball tactics, but it is difficult for students to form an effective understanding of basketball techniques and tactics. In particular, the development of basketball technology requires students to carry out additional practice to achieve the desired results. After school, students usually play basketball outside the classroom, not indoors. In fact, as far as the current reality is concerned, basketball teaching is limited to the classroom, and there is no contact between teachers and students. Therefore, some problems that students encounter in extracurricular activities are difficult to solve, which hinders their improvement of basketball skills.

(3) Inadequacy of basketball track image information

Basketball is one of the most popular sports. The image processing technology can be used to track the basketball flight path, which is mainly combined with the computer 3D visual analysis technology. The image processing equipment can be used to collect image sequences, detect the image edge width and contour attributes, and establish a visual analysis database. Traditional basketball track tracking technology mainly includes scale conversion method, flight track tracking technology adapted to angle characteristics and basketball track tracking technology based on wave field profile edge detection [15], as displayed in Figure 2.

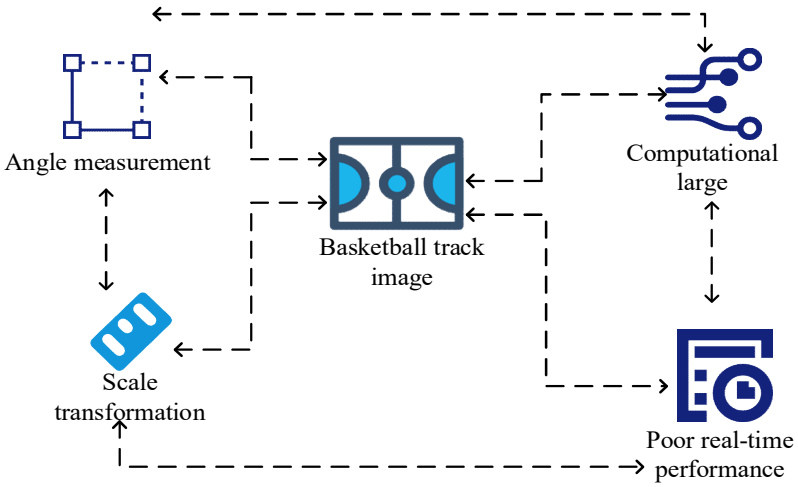

Figure 2: Insufficient image information of the basketball movement trajectory

IV. Image Video Sequence Analysis Algorithm to Strengthen Basketball Flight Path Analysis

The electronic imaging equipment is used to collect the basketball flight image video sequence. The frame difference of the basketball flight image video sequence is defined as M, the discrete sampling rate is $P=[1,-1]$, and the edge contour block pheromone is:

$$\min M=(f_1(x),f_2(x),f_n(x))^t \tag{1}$$

$$M_n\le 0,\ \ i=1,2,...,n \tag{2}$$

$$P_j=0, j=1,2,...,m \tag{3}$$

According to the kinematics theory of basketball flight trajectory tracking, the information feature model of action image in basketball flight trajectory tracking is constructed as follows:

$$D(x,y)=\sum[u(x_i,y_j)-u(x_i+\nabla x_i,y_j+\nabla y_j)]^2 \tag{4}$$

Among them, $\nabla x_i,\nabla y_j$ are the probability functions of position distribution of basketball flight image in the air, and x_i,y_j are the coordinate points of basketball flight track tracking.

The edge pixel set of basketball flight track tracking is:

$$M_{edge}=[L_m^n]_{ij} \tag{5}$$

The 3D view switching method is used to correct the dynamic error of the target image and perform fusion tracking of flight path motion information. The fusion tracking equation is expressed as:

$$x=\delta\cos\theta\cos\varphi_v, y=\delta\sin\theta \tag{6}$$

$$k=-\delta\cos\theta\cos\varphi_v,\mu=w\sin\eta+w\cos\eta \tag{7}$$

Among them, x,y,k are the fusion information points of local information of basketball flight path. φ_v is the deflection angle of basketball flight track tracking.

By extracting the edge contour features of the image, the contour information points of the image sub block area at (x,y,δ) are obtained:

$$g=k\cdot f+n \tag{8}$$

The interpolation fitting method is used to obtain the information points of the image video sequence:

$$R_1H(t)=v(t)+\alpha(t)w(t) \tag{9}$$

$$R_1 H(t) = v(t) \tag{10}$$

$v(t)$ represents the edge information of the image and $w(t)$ represents a non Gaussian statistic. $\alpha(t)$ represents the scale of sub block segmentation, H represents the uniform quantization scale. The gray pixel value feature points of the tracking image video sequence can be fitted, and the tracking model is:

$$V_i = \frac{\sum_{k=1}^{n} \Delta_j^i (1-(1-u_{ik}^{\alpha})^{\alpha})^n (x_k + \alpha_{xk})}{(1+\alpha)\sum_{k=1}^{n} \Delta_j^i (1-(1-u_{ik}^{\alpha})^{\alpha})^n} \tag{11}$$

Among them, u_{ik} is the search threshold of flight radial direction, α is the uniform blocking coefficient and x_k is the fuzzy control coefficient.

V. Positive Value and Basic Principles of Applying IRT in College Basketball Teaching

(1) Improve the application of IRT in basketball flight path

Aiming at the shortcomings of traditional methods, this text proposes a basketball trajectory extraction method based on image sequence analysis. First, this text collected a series of video images of basketball flight path, and then used random scaling technology to process the images to reduce noise. Then it tracks the gray pixels in the image sequence. This text makes a quantitative analysis of basketball trajectory. The noise output image can be used as the sample to analyze the image, correct the characteristic gray pixels, track the image and image sequence, and realize the flight path image analysis. The analysis results show that the sequence analysis method can match and extract the characteristic gray points of basketball flight path well, and has good image tracking characteristics. The sequence analysis method is used to track the basketball track, with small error and high accuracy.

(2) Based on IRT to create diversified curriculum content

As a sport, basketball itself has the nature of entertainment. Learning basketball can completely relieve the pressure of students. In traditional basketball teaching, teachers only focus on the explanation of basketball, ignoring the spiritual cultivation of basketball itself and the inheritance of human nature, leading to the gradual decline of students' interest in basketball. Due to the lack of understanding, teachers can only accept the teaching passively. If it continues for a long time, the teaching effect of school basketball lessons can be imagined, and the teaching content is seriously disconnected from the actual needs of students. The single curriculum content is the disadvantage of school basketball curriculum. Using IRT can expand teaching content, and creating diversified teaching content is an important method of reform [16]. Throughout the history of basketball development, there are many excellent resources for learning. Basketball has many statistics, including points, basketball, passing, interception, shooting lock, etc. These different data can reflect the connotation of basketball teaching. Therefore, based on IRT, statistical data related to basketball data can be extracted from sports websites or professional basketball databases, and the image recognition platform can be used to analyze students' basketball data during learning. With the basketball league as the core, through the introduction of relevant basketball games based on IRT, it provides students with sports event management courses and creates the content of sports event management knowledge, as displayed in Figure 3. Due to the diversity of teaching and the expansion of curriculum content, basketball teaching in schools has become colorful. The single education mode must be changed. In the traditional basketball teaching, the teacher uses a very simple teaching mode. The teacher explains the basketball movements in the classroom, and the students train according to the basketball movements explained by the teacher. Under the long-term influence of this model, students' thinking has been imprisoned and they have no ability to think independently, which is a bad phenomenon for students. The long-term development will also affect the efficiency of basketball teaching. Therefore, teachers should create an active and open learning atmosphere in the teaching process, give students more freedom and space, and change the traditional teaching methods. Students can put forward problems independently and solve them themselves. Teachers should help students in this process, as shown in Figure 3. At the end of the course, teachers should summarize and reflect. It is very important to effectively summarize and reflect on their learning process. Highlights in the learning process must be maintained and further developed. Problems in the classroom should be summarized and corrected in a timely manner.

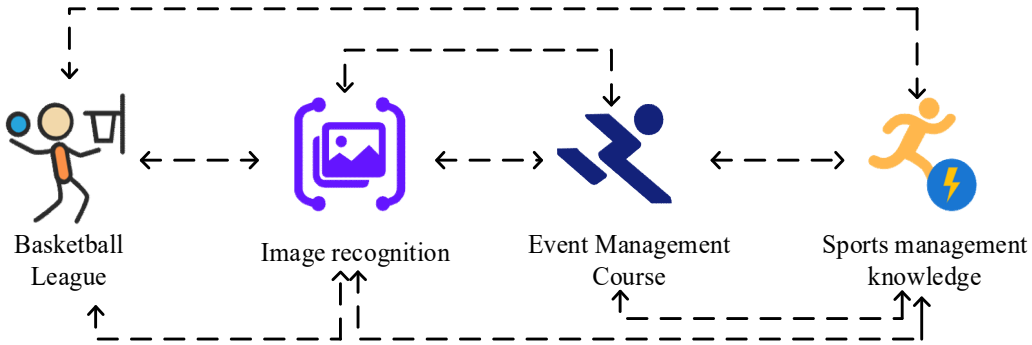

Figure 3: Create a diversified course content based on the IRT

(3) Innovation of basketball teaching methods based on IRT

With the diversification of basketball teaching content, in order to create a better learning environment for students, it is necessary to introduce basketball teaching methods and resources based on innovative IRT. New media is a new product in the Internet era. New media oriented to text, photos and short videos have become more professional and convenient. In basketball teaching, teachers can choose professional media from new media to support learning according to different shared resources. Sports software can be used to support education. At present, there are many professional basketball projects, including basketball techniques and tactics. Some even have corresponding learning, comparison and learning functions. In basketball teaching, teachers can implement these plans to support basketball teaching. Basketball lessons should not be limited to classroom learning, but should be actively promoted to extracurricular activities. Teachers must use IRT to make basketball teaching go deep into students' daily activities. First of all, people can use instant messaging tools to create basketball training groups. Teachers can put some topics in exchange groups to discuss basketball, allowing students to participate in extracurricular discussions, so as to maintain the motivation of basketball. In basketball class, teachers can broadcast their training scenes to students for extracurricular personal exercises, and students can adjust their technical actions on the spot. Extracurricular activities can be completed with professional basketball software, which creates classroom groups. At the same time, students install software and upload their daily exercises to the software. The teacher checks students' exercises with software and gives suggestions in time, as displayed in Figure 4. This would help to establish an organic relationship between teachers and students after class and make basketball teaching more effective.

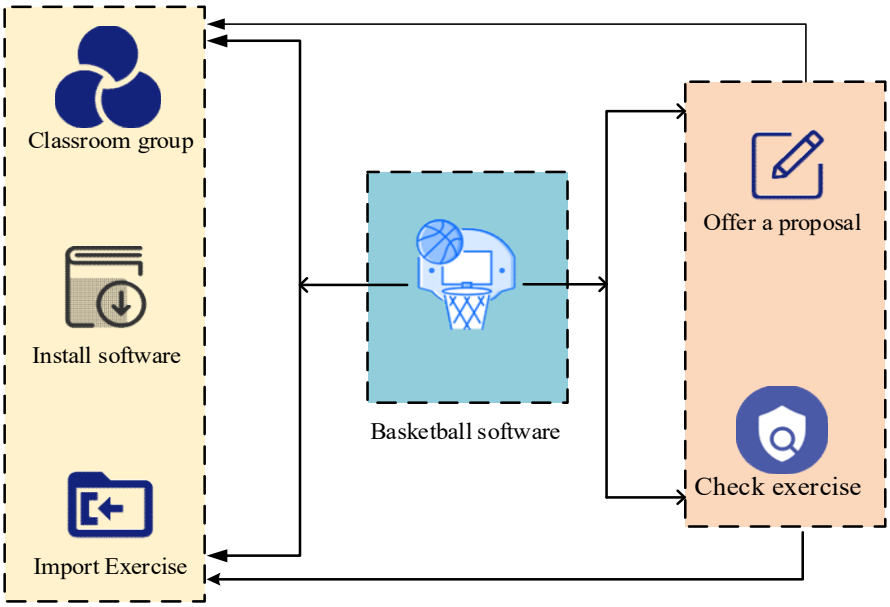

Figure 4: Innovating basketball teaching methods based on IRT

VI. Combining Image and Video Sequence Analysis Algorithm with Experimental Investigation

In order to further the current situation of basketball teaching in schools, this text conducts an investigation and interview on four schools to investigate students' satisfaction with the teaching content of the current basketball course. The school is divided into: A, B, C, D, using the form of a questionnaire. The survey content is mainly summarized into three points, respectively, to investigate teaching innovation, teaching content, and teaching methods. From these three points, the sample number of students is 400, and the survey is displayed in Table 1.

Table 1: Students' satisfaction with various teaching-related aspects of the current basketball curriculum teaching

	A	B	C	D
Teaching innovation	65%	73%	70%	64%
content of courses	73%	69%	65%	70%
teaching method	74%	64%	63%	71%

It can be seen from Table 1 that the satisfaction of the students of the four schools with the teaching innovation, teaching content and teaching methods in the current basketball course teaching is at a relatively stable level. The specific data is that the students of School A are 65% satisfied with the teaching innovation of the current basketball course teaching. Satisfaction with teaching content accounted for 73%, and teaching methods accounted for 74%. The students of School B are 73% satisfied with the teaching innovation of the current basketball course teaching, 69% satisfied with the teaching content and 64% satisfied with the teaching methods. The students of School C are 70% satisfied with the teaching innovation of the current basketball course teaching, 65% satisfied with the teaching content and 63% satisfied with the teaching methods. The students of School D are 64% satisfied with the teaching innovation of the current basketball course teaching, 70% satisfied with the teaching content and 71% satisfied with the teaching methods.

Detection and noise reduction performance of current basketball movement track image information analysis to investigate the accuracy, this text randomly selected three basketball matches. It uses the traditional basketball movement track image information analysis to analyze the flight track of 80 goals in the game. The three basketball games are set as A, B and C. This text investigates the proportion of the analysis accuracy, detection and noise reduction performance of the traditional basketball trajectory image information analysis system for basketball goal trajectory. The specific effect is displayed in Figure 5.

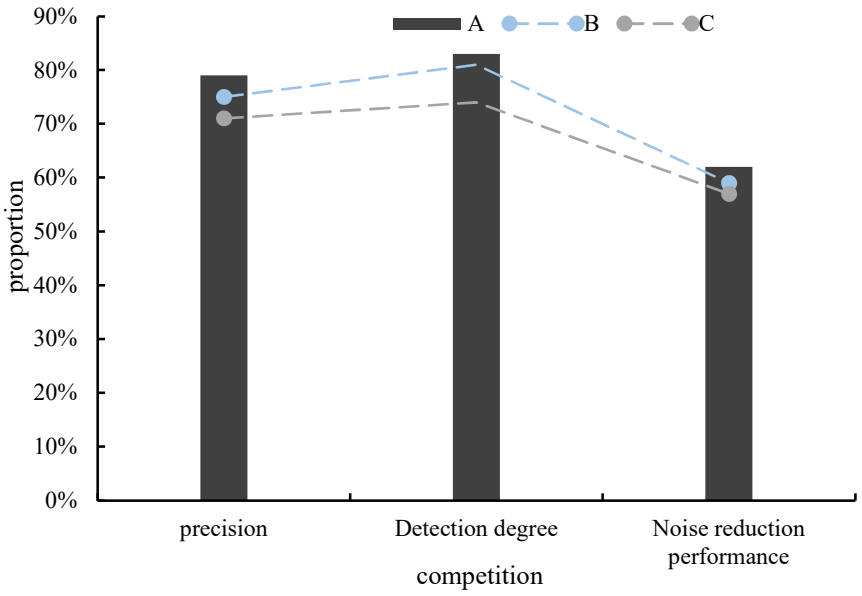

Figure 5: The accuracy, detection degree and noise reduction performance of the current basketball movement trajectory image information analysis

As displayed in Figure 5, in the analysis of the goal flight trajectory by using the traditional basketball motion trajectory image information analysis system, the detection degree is maintained at a relatively stable and good

level, while the noise reduction performance is relatively insufficient. The details are as follows: The accuracy of the traditional basketball trajectory image information analysis system in the A event is 79%, the detection rate is 83%, and the noise reduction performance is 62%. The accuracy of the traditional basketball movement track image information analysis system is 75%, the detection is 81%, and the noise reduction performance is 59%. The accuracy of the traditional basketball trajectory image information analysis system in the C event is 71%, the detection is 74%, and the noise reduction performance is 57%.

The development of everything has a process. In order to strengthen the analysis intensity of current basketball movement track image information, image video sequence analysis algorithm can be introduced into the construction of basketball movement track image information, and a new basketball movement track image information system can be designed. In order to investigate the application ability of the new basketball motion track image information system in basketball flight path analysis, this text re selected 80 goals in three basketball matches for image analysis. The three basketball matches are set as A, B and C. The survey content is still accuracy, detection and noise reduction performance. The survey results are displayed in Figure 6.

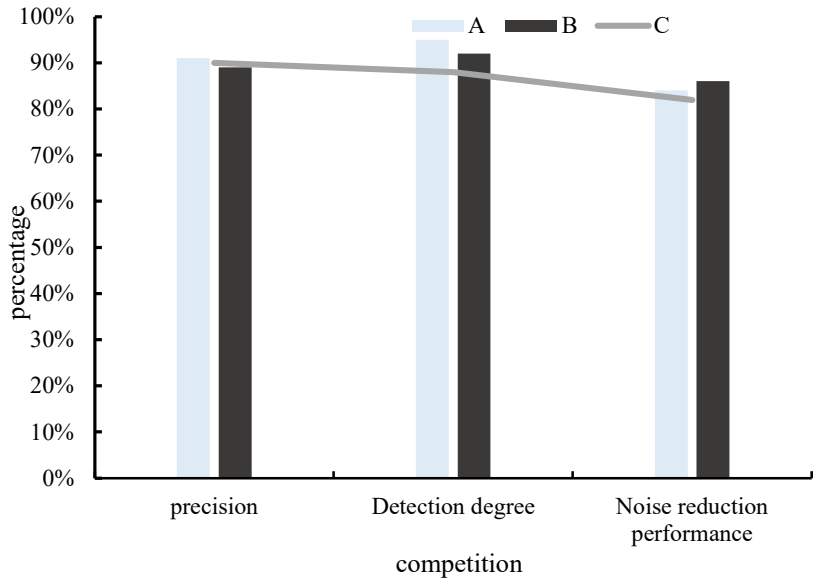

Figure 6: Application ability of new basketball trajectory image information system in basketball flight path analysis

As displayed in Figure 6, the image video sequence analysis algorithm can be used to introduce into the construction of basketball movement track image information, and a new basketball movement track image information system is designed. The detection level has been significantly improved, while the noise reduction performance has been significantly improved.

The details are as follows: The accuracy of the new basketball movement track image information analysis system in A match is 91%, the detection is 95%, and the noise reduction performance is 84%. The accuracy of the new basketball movement track image information analysis system in event B is 89%, the detection is 92%, and the noise reduction performance is 86%. The accuracy of the new basketball movement track image information analysis system in C matches is 90%, the detection is 88%, and the noise reduction performance is 82%. According to the experiment and investigation, the image video sequence analysis algorithm can be introduced into the construction of basketball trajectory image information, and a new basketball trajectory image information system can improve the detection efficiency of basketball flight path analysis by 25.8%.

In order to detect the difference between the new basketball trajectory image information analysis system and the traditional basketball trajectory image information analysis system, the change of basketball teaching efficiency in a school under two kinds of basketball trajectory image information analysis systems was investigated. This text investigates eight classes in four schools, four of which adopt traditional basketball teaching strategies. The other four classes adopted the new basketball teaching strategy designed by the new basketball track image information analysis system, and investigated 200 students. This text conducts a comprehensive evaluation to investigate students' learning materials, curriculum content and teaching diversity in basketball teaching, as displayed in Figure 7.

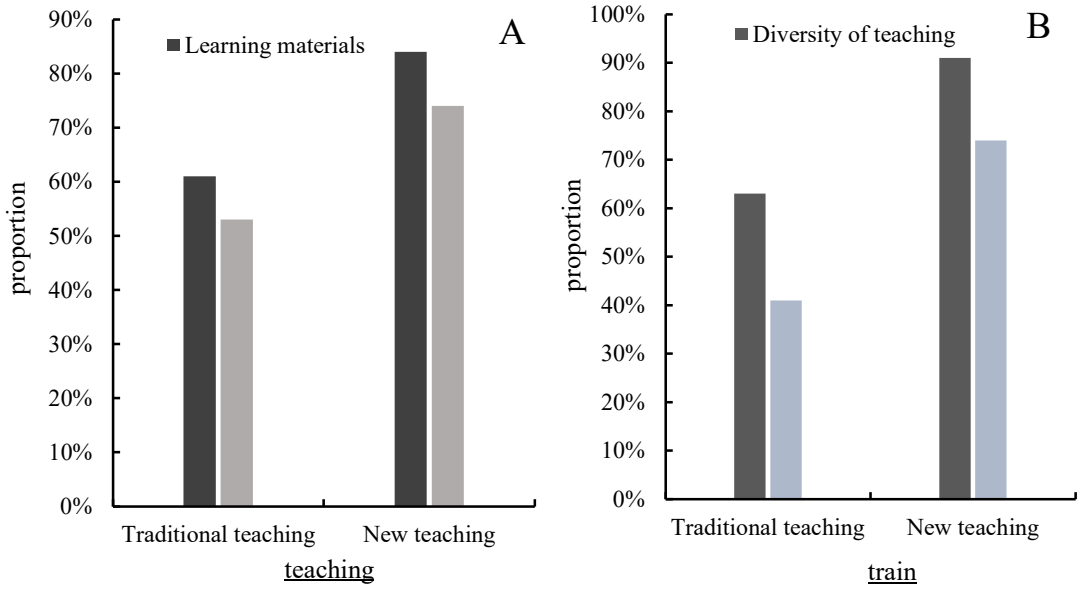

Figure 7: Changes of basketball teaching efficiency under two basketball trajectory image information analysis systems

It can be seen from the histogram in Figure 7 that compared with the two basketball teaching strategies, students' satisfaction with learning materials in the new basketball teaching strategy is 93%. 91% of the students were satisfied with the content of the courses and 94% with the diversity of teaching. However, students' satisfaction with learning materials, curriculum content and teaching diversity accounted for 84%, 78% and 79% respectively in traditional basketball teaching strategies.

VII. Conclusions

The purpose of basketball education is to popularize basketball and cultivate students' lifelong sports skills and exercise habits. In the process of basketball education, it should combine the needs of social development, cultivate basketball talents, and meet social needs. At the same time, it must establish an advanced education model, establish a correct education concept, constantly optimize the curriculum, and improve the physical, physical, basketball and psychological quality of students. Comprehensive personality development would prepare students for future employment. In order to improve the shooting standard and accuracy in basketball training, this text proposes a basketball trajectory tracking method based on motion sequences. First of all, by collecting video sequences of basketball flight trajectory images, the random scaling technology can be used to denoise the images. In basketball technology teaching, teachers should not only master the specific methods to achieve different goals, but also reform and combine these methods, and finally combine them with basketball practice. The results show that the basketball flight trajectory tracking method has high accuracy and small error, which has good theoretical significance for basketball training.

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