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Research Article

Intelligent Monitoring of Basketball Teaching Action Optimization considering Heterogeneous Grouping Algorithm

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With the continuous development of social economy, sports have become an important part of people's daily life, especially ball sports are becoming more and more popular. However, in physical education, the standardization and rationality of teaching actions are extremely important. In view of these needs and limitations, a heterogeneous grouping algorithm is introduced in this paper, taking basketball teaching as the entry point, the situation of heterogeneous grouping teaching and learning are analyzed under different teaching organization through combing the business flow of basketball teaching, and the modified factor algorithm is used to conduct a process evaluation of basketball teaching. The simulation experiment results show that the heterogeneous grouping algorithm is effective, can support the intelligent monitoring of basketball teaching action optimization, and promote the improvement of basketball teaching effect, and students can get more room and level for improvement.

1. Introduction

With the continuous development of society and economy, the physical condition and learning situation of students have increasingly attracted the attention of society and families [1]. More families pay more attention to academic performance and neglect physical exercise, which often leads to lack of physical fitness [2]. Traditional physical education is often passive teaching, that is, singular and passive teaching. This method often fails to conduct effective analysis and grouping according to students' interests and specialties, which inhibits students' self-development [3, 4]. In view of these limitations, the scholars within the industry have made in-depth research and practical exploration. Typically, for instance, mixed teaching is performed for the students with different skills and different knowledge. Students learn from each other in the group to increase their enthusiasm for autonomous learning, thereby achieving the improvement of students' self-exercise ability, giving full play to their subjectivity. To a certain extent, it has changed the teaching from the single teaching in the past to the active and personalized teaching [5]. On the premise of fully considering the physical fitness of students, it is extremely effective to effectively formulate targeted basketball teaching courses. Especially in today's continuous development of sports, it is necessary to promote more interaction among students, teachers and students, to promote students' enthusiasm for physical exercise, and to give full play to students' creativity and innovation.

Different from the existing models abroad, the current teaching model in our country mostly uses random grouping and free combination for classified competitions. Such grouping often leads to a large difference in overall skill level, which inhibits the collaborative learning exploration. [6]. It is worth noting that students are the future of the country, and their health determines the long-term development of the nation and the country's economic revitalization. Because of this, the physical fitness of students should receive more attention. The guidance of students' physical health is mainly based on guiding and heuristic strategies. It is not only an attempt of practical education, but also an important direction for participation. Compared with foreign practice, China has relatively few interventions for students, and the frequency is not enough [7, 8].

Therefore, the heterogeneous grouping method is gradually being valued and favored by the industry and scholars. Its essence is a collective teaching, that is, the students are artificially grouped according to different characteristics and technical levels. Such grouping is mainly to distinguish students in the same group. Meanwhile, the relative gap between such groupings is small, and students can help each other and grow up according to their own characteristics. This small group teaching method is grouped effectively based on the resources, allowing students to experience improvement and progress in the collective atmosphere, through mutual help and promotion of excellence, to ensure that the members of the whole group progress together.

In view of these needs and deficiencies, basketball teaching is sorted out based on the heterogeneous grouping algorithm; the intelligent monitoring of basketball teaching actions is used to count the situation of heterogeneous grouping teaching and learning, to use the modified factor algorithm to carry out evaluation of basketball teaching process, and aims to further improve the effectiveness and teaching results of basketball teaching.

2. Objects and Methods of Research

2.1. Research Object. Set up the corresponding research objects. From the perspective of basketball teaching, two classes are randomly selected for experimental comparison. Each class has a certain basketball foundation, of which one class is an experimental class and the other is a control class.

2.2. Research Method. The corresponding research methods are used to realize the level analysis, teaching comparison, teaching feedback, and effect evaluation analysis of the students in the experimental class and the control class. In order to eliminate external influence factors and errors as much as possible, while realizing the comparison of the two classes, other external conditions are the same.

2.2.1. Experimental Purpose. In order to effectively verify the effectiveness of the heterogeneous grouping algorithm, explore the teaching effect of the experiment.

2.2.2. Pre-Experiment Diagnostic Test. For the students in the experimental classes and the control class, an effective level assessment is carried out, and T test of the data is used to judge the validity of the heterogeneous grouping.

2.2.3. Heterogeneous Grouping Method. According to the students' physical fitness and technical level, three levels are equally divided. Meanwhile, the specific students are divided into 6 groups, each with 5 people, relatively equal in strength, and there are students with high, medium, and low basketball skills. In the meantime, reasonable teaching cooperation and teaching competitions are carried out.

2.2.4. Check the Content and Standards of the Experimental Effect Index Evaluation. In the teaching process of the heterogeneous grouping algorithm, cooperative interaction is realized, and cooperative teaching is carried out in the way of intragroup competition, which further clarifies the concept of students' collective thinking, enhances students' cohesion, experiences cooperation and unity of ball games, and improves the enthusiasm and effect of basketball physical exercise.

During the process of experimental teaching, each group must carry out an effective implementation assessment, and its specific assessment indicators are based on teaching competition of each technology.

(1) The Teacher's Evaluation of the Student's Learning Process. During each stage, the teacher scores according to whether the corresponding learning goal is achieved, the progress of the subject, the spirit of unity, etc., and effectively scores according to the threshold range of [1, 4].

(1) First Conduct Self-Assessment and Peer Evaluation. During the course of a fixed competition, students' self-assessment and peer evaluation are carried out. As shown in Table 1, the average value of students' peer scoring is calculated.

(2) Modified Factor Method. According to the comprehensive evaluation of the relevant teachers and students on the learning process, peer evaluation/self-assessment is set as the specific modification factor of the group evaluation, so that the individual's final score can truly and effectively feedback the specific situation of the individual in the group learning process.

(2) Summative Evaluation of Student Academic Performance. In real physical education, in view of the standardized technical actions, timely feedback of effects, and improvement of technical level that students should have in the process of physical education, three specific assessment contents are selected for effective assessment and effective evaluation of learning effects in this paper, which accounts 60% in the basketball technical assessment.

(3) The Special Technical Evaluation Scores and the Proportions of Each Part of the Experimental Class and the Control Class. The total evaluation score of the experimental class is set as 100, the process evaluation accounts for 40%, and the end of study evaluation accounts for 60%;

The total score of the control class is set as 100, the evaluation score of the end of learning accounts for 60%, and the evaluation score of the teaching competition accounts for 40%.

2.2.5. On the Basis of Calculating the Relevant Scores, the Mean Value of Each Item Is Calculated, the Statistical Software Is Used for Effective Statistical Analysis, and Effective Heterogeneity Test Is Performed for Basketball Skills and Internal Motivation [9, 10]. First set up the corresponding intelligent sensor; the data transmission delay of the terminal request location and the server base station location can both be set as d, the clock deviation of the two locations is set to Δt, the server base station receives

Table 1: Contents of self-assessment and peer evaluation of students for basketball as in ordinary colleges and universities a special item.

Evaluation index and score	4 points	3 points	2 points	1 point
Technical levels	Very skilled	Relatively skilled	Have a certain level of technology	Poor technology
Physical quality level	Easy to adapt to the game	General adaptation to the game	Reluctantly adapt to the game	Cannot adapt to the game
Progress	Very obvious	Relatively obvious	Some progress	Less progress
Participation	Very proactive	Relatively proactive	Average attitude	Passive, lack of confidence

the corresponding data at T2 and T3, respectively, and reply the response data to the requesting terminal. After the data requesting terminal receives the corresponding data, it can be quantitatively calculated according to formula (1).

The deviation calculated by each requesting terminal can be corrected according to the corresponding atomic clock to realize the time synchronization between the data request and the data server [11–14].

$$\begin{cases} T_2 = T_1 + d + \Delta t \\ T_4 = T_3 + d - \Delta t \end{cases} \Rightarrow \begin{cases} d = \dfrac{(T_2 - T_1) + (T_4 - T_3)}{2} \\ \Delta t = \dfrac{(T_2 - T_1) - (T_4 - T_3)}{2} \end{cases}. \tag{1}$$

On this basis, the data request terminal applies for the corresponding data, which includes the number of terminal nodes, the period of the time slot, the start and end time of the time slot, and other corresponding metadata information. These parameters are all analyzed by the data request terminal for corresponding initial settings.

After receiving the corresponding data from the data server, the data requesting terminal determines the specific time of the data requesting terminal according to the information of the data, so that the corresponding configuration can be completed according to the static time slot; the specific calculation is shown in formula (2), when setting. The data requesting terminal needs data to be sent, and data transmission is performed.

$$t_i = t_0 + (i-1) \times 2l + k \times T, k \in \{0, 1, \cdots\}. \tag{2}$$

It should be noted that when the data requesting terminal retransmits the data in the time slot of the server's continued transmission, first, the retransmission of part 1 is continued, and the time at this time can be calculated by formula (3); when the retransmission part 1 does not receive the response data from the data server, it enters the retransmission part 2. At this time, the retransmitted time slot can be calculated by formula (4). When the corresponding data is not received in the part 2 of the retransmission, it is similar to 1 and 2; it enters retransmission part 3 for continued transmission, and the retransmission time slot at this time can be calculated by formula (5). However, if the response data from the data server is still not received, the terminal requesting node stops the continued data transmission, enters the planting state, and waits for the administrator's next cycle.

$$t_1 = t_0 + (n + r_1) \times 2l, r_1 \in \left\{0, 1, \cdots, \frac{n}{5}\right\}, \tag{3}$$

$$t_2 = t_0 + \left(\frac{6n}{5 + r_2}\right) \times 2l, r_2 \in \left\{0, 1, \cdots, \frac{n}{25}\right\}, \tag{4}$$

$$t_3 = t_0 + \left(\frac{31n}{25 + r_3}\right) \times 2l, r_3 \in \left\{0, 1, \cdots, \frac{n}{125}\right\}. \tag{5}$$

When a data terminal node encounters emergency data transmission, it first needs to be authenticated by the data server, and the node can communicate with the terminal through the data server to allocate shadow time slots. The specific calculation is shown in formula (6):

When data is being transmitted, the data requesting terminal performs data transmission in the shadow time slot of the data server.

$$t_j = t_0 + (2j-1) \times l + t \times k, k \in \{1, 2, \cdots\}. \tag{6}$$

This article selects the corresponding student groups for research, one of which is used as the experimental class, and the other is used as the corresponding verification class, as shown in Figure 1.

The research method is shown in Figure 2. It can be seen from the results that the corresponding effective rate can be obtained in multiple measurements before and after the intervention. The average effective rate of the data used for quantitative analysis is higher than 80%, which meets the statistical requirements.

In the actual investigation and research, the corresponding teachers were selected for effective communication to ensure the progress and effect of the experiment.

On this basis, a lot of sports theory experts and sports teachers are also interviewed, and the corresponding consultation and analysis are conducted from the current physical fitness and exercise situation.

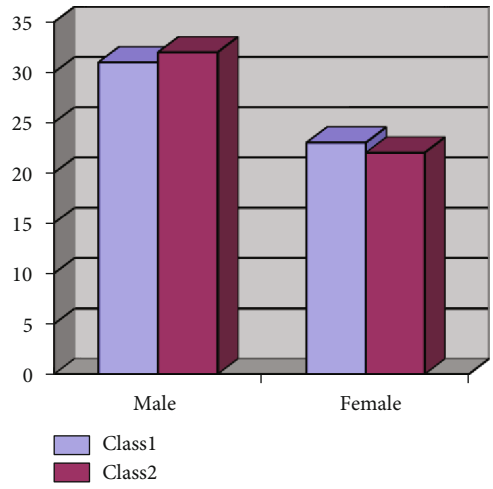

Figure 1: Statistics of the number of subjects.

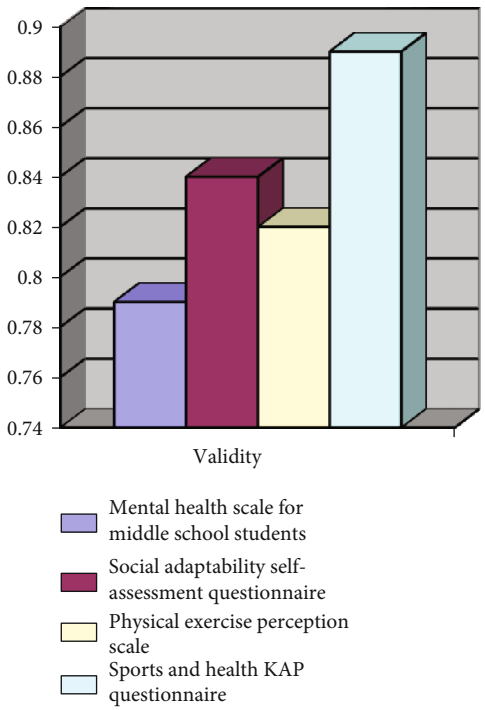

Figure 2: List of basic information of each scale (questionnaire).

3. Analysis and Realization of the Key Technology of System

In view of the research status of basketball teaching, the heterogeneous grouping algorithm proposed in this paper effectively realizes the optimal intelligent monitoring of basketball teaching actions, namely, according to image processing, basketball court sideline monitoring, sports goal monitoring, and action tracking, and the effective analysis of basketball teaching action analysis is realized.

3.1. Preprocessing of Video Images. First, the grayscale of basketball teaching action videos shall be realized. The traditional grayscale methods usually mainly include the

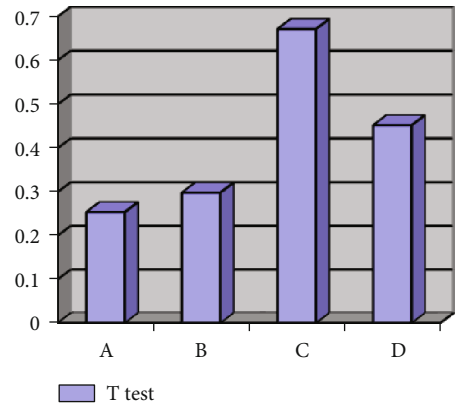

Figure 3: Examination of the physical health indicators of the students in the experimental class and the control class before the experiment.

average method, the weighted average method, and the maximum method [15–17]; no matter which method is used, the image feature can be changed effectively and even cause the loss of data. It can be solved by using the gray conversion formula as

$$\text{Gray} = 0.299R(x, y) + 0.587G(x, y) + 0.114B(x, y), \quad (7)$$

$$R(x, y) = G(x, y) = B(x, y) = \text{Gray}. \quad (8)$$

Secondly, the grayscaled image is effectively denoised. During the process of video processing, possible noise comes from image processing. Generally, image denoising processing shall be performed for the edge detection, image segmentation, and effective feature extraction and other processes. In this paper, a filter is used for denoising processing.

Finally, the image is binarized. Image binarization is to use the effective motion knowledge and background of the image to separate and to provide a basis for image detection. The corresponding threshold is used for effective selection; the overall and partial binarization analysis of the image can be analyzed.

3.2. Stadium Sideline Detection. Because the position of the shooting camera is fixed during basketball teaching, the sideline of the video does not change. However, during the actual teaching process, because of the influence of external factors such as different colors and billboards, the difficulty in detection of sidelines in basketball courts has been increased. Generally, the industry uses corresponding operators for extraction, such as Sobel operator and Roberts operator, but these operators usually have limitations such as complex recognition process and long operation time.

In this paper, Canny's operator is used for effective court sideline detection. Its main advantage is that it can use detection, positioning, response, and other aspects for effective analysis:

(1) The process of basketball teaching videos can effectively realize as many marks as possible

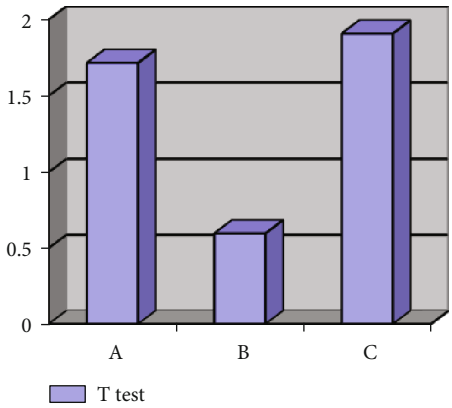

Figure 4: Before the experiment, technical assessment performance test of the experimental class and the control class students.

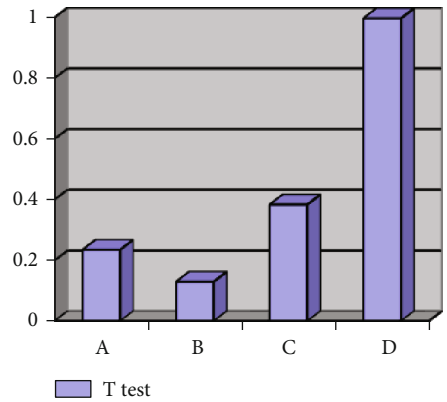

Figure 5: After the experiment, the increase rate and test of the physical health indicators of the experimental class and the control class.

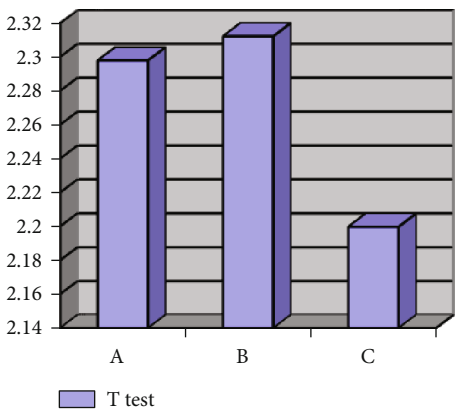

Figure 6: Test of the improvement range of students' technical performance in the experimental class and the control class.

(2) The process edge detection of basketball instructional video should be as close to the edge as possible

(3) The edge of basketball instructional video can only be marked once and cannot be affected by external image noise

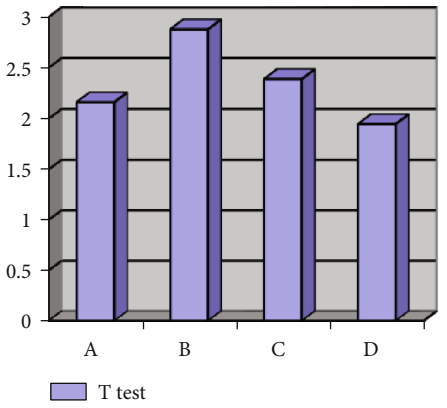

Figure 7: Statistics and inspection of some technical indicators in the 10-min teaching competition between the experimental class and the control class.

The main algorithm steps include the following:

(1) Denoise first. It cannot get better analysis results that the edge detection algorithm is applied to unprocessed images. Therefore, before processing, it is necessary to perform Gaussian smoothing of image noise to eliminate the adverse effects of response

(2) Secondly, look for the corresponding brightness gradient in the image and use 4 directions to detect the edges, which are vertical, horizontal, and diagonal directions, to identify the maximum value and edge direction of each point in the image

(3) The edge of the image is tracked, and the threshold value is used to determine the brightness gradient value, which effectively solves the problem of large brightness gradient

3.3. Moving Target Detection. During the actual impact sampling process, moving target detection is used to realize the segmentation of the moving foreground, and the feature analysis of the two-dimensional image is carried out with the help of grayscale, texture, and edge. It is a method to detect moving objects by comparing the current frame in the image sequence with the background reference model. Its performance depends on the background modeling technology used [18–21].

3.4. Moving Target Tracking Algorithm. Moving target tracking is to establish a corresponding matching problem based on the target shape, color, texture, and other related characteristics between consecutive images. The purpose is to obtain the coordinate position of the moving target in each frame of image and then associate these data to obtain the target.

4. Results and Analysis

4.1. Experimental Results and Analysis. Effectively test and compare the indicators and basketball skills of the

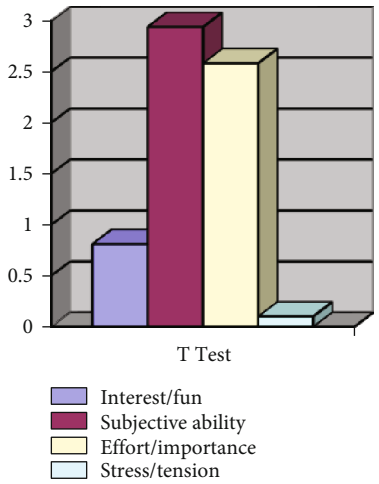

Figure 8: Test results of various dimensions of internal motivation of students in the experimental class and the control class.

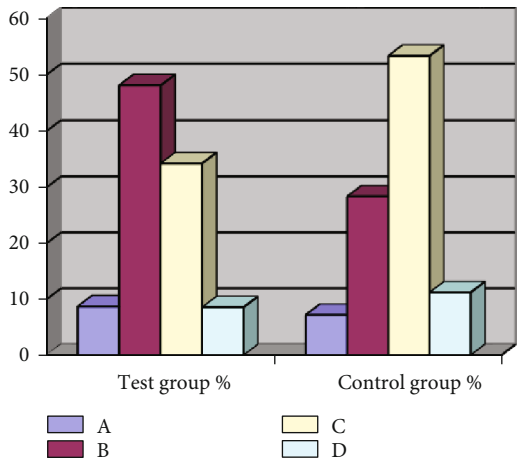

Figure 9: Comparison of the physical fitness classification of middle school students after the intervention and during the back test.

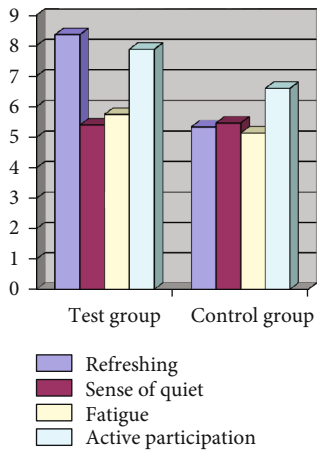

Figure 10: Comparison of changes in feelings of middle school students' physical exercise after intervention and during back test.

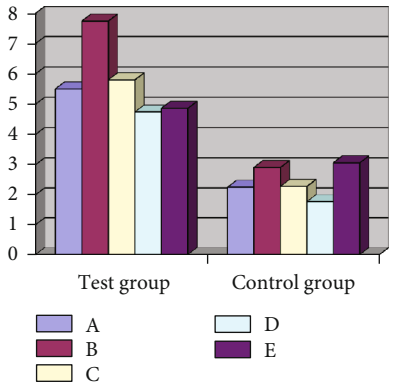

Figure 11: Comparison of awareness rate of KAP questionnaire after intervention.

experimental class and the control class. The test results are effectively tested. The specific results are shown in Figures 3 and 4. Among them, standing long jump is represented by A, vital capacity index is represented by B, grip strength and body mass index is represented by C, solid ball is represented by D, the three basketball skills are represented by a pass A with both hands on the chest, a figure eight dribble is represented by B, and a shot with a single hand on the shoulder is represented by C.

4.2. Comparative Analysis of Experimental Results

4.2.1. Analysis and Test of the Results of the Physical Health Indicators of the Two Groups of Students After the Experiment. The two forms of teaching organization can improve students' physical function level, and there is no significant difference. A is standing long jump, B is vital capacity index, C is grip strength and body mass index, and D is a solid ball (Figure 5).

4.2.2. Process Evaluation Analysis of Experimental Class Students. The function of evaluation is mainly to reflect students' progress in learning in a timely manner and to encourage students to actively reflect and summarize the learning process.

4.2.3. The Summative Evaluation Analysis of the Students' Academic Performance in the Experimental Class and the Control Class

(1) Comparison of Technical Performance between Experimental Class and Control Class. At the end of the semester, the experimental classes and the control class were both evaluated for technology, and three techniques were used for analysis. The experimental results showed that the analysis between groups has a clear sense of autonomous learning. Through mutual help between the groups, an effective improvement of the technical level has been achieved. The competition among groups makes students have common goals and become more autonomous and motivated (Figure 6).

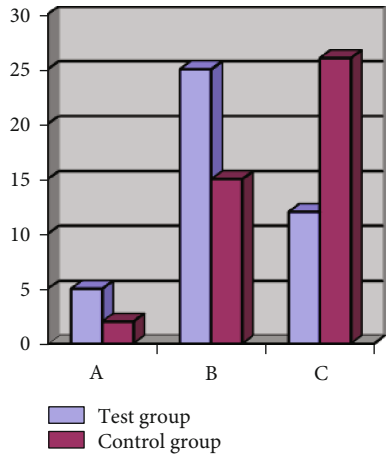

Figure 12: Comparison of data of action skills assessment in heterogeneous group teaching experiments.

(2) Comparison of Competition Ability. According to the 10-minute teaching and competition situation of the experimental class and the control class, violations, fouls, assist, steals, and other indicators representing the students' competition ability are counted. A is an aggression foul, B is a walking violation, C is an assist, and D is a steal (Figure 7).

(3) Comparison of Various Dimensions of Internal Motivation of the Students in the Experimental Class and the Control Class after the Experiment. By comparing the experimental classes and the control class, students have significant differences in terms of relevance, subjective initiative, and importance (Figure 8).

The results show that heterogeneous grouping teaching can give full play to the characteristics of students and realize mutual learning, mutual communication, and mutual influence. Because students are heterogeneous, students with a certain gap will continuously make progress and study harder to improve their technical level. Meanwhile, they can also recognize their own shortcomings and work harder to ensure their leading position in the class.

As shown in Figure 9, after the intervention of sports and nutrition, the excellent rate of physical fitness in the test group was significantly higher, increased by 8%, the good rate increased by about 20%, and the unqualified rate decreased. From the results, the comprehensive combination of sports and nutrition has a significant positive effect on the improvement of students' physical fitness, which can ensure that students develop good exercise habits and improve their physical fitness.

The results after the comprehensive intervention are shown in Figure 10. The students in the test group are more active and motivated, especially when compared with the nonintervention group, the results are more obvious. Meanwhile, the sense of quietness and fatigue have changed, indicating that the students are actively participating in physical exercises, but they still have a certain degree of fatigue, which is worth noting and paying attention to.

4.2.4. The Influence of Sports and Healthy Exercise Prescriptions on Students' Health Knowledge, Beliefs, and Behaviors. From the results in Figure 11, it can be seen that after the intervention, the students' scores on the theoretical knowledge of physical education increased by about 50%, and their participation in healthy behaviors even increased by about 53%. The effect was very obvious. The simulation experiment shows that the intelligent sensor is effective and can effectively monitor.

4.2.5. The Impact of Sports and Health Exercise Prescriptions on Students' Social Adaptability and Mental health. Physical education activities are group activities that accomplish teaching tasks through the interactive behavior of teaching, learning, and training between teachers and students and between students.

4.3. Analysis of Motion Skill. The analysis and assessment of movement skills is the most direct factor for students to learn basketball. Students can express the effect of the whole set of movements through specific situations [22–26]. If each student's movement skills are not up to standard, it may affect the overall performance and movement of the team. Therefore, for the assessment of movement skills, the most basic assessment analysis is realized. The specific relevant assessment content is designated by the basketball teacher and completed by the students independently. The specific assessment data is shown in Figure 12:

Independent sample $T = 2.285$. According to the above table, after 16 weeks of study, the students in the test group and the control group have significantly widened the gap in basketball skills. The students in the test group who adopted the heterogeneous grouping teaching model have made more obvious progress.

5. Conclusions

With the continuous development of social economy, ball games in colleges and universities are becoming more and more popular. Most of these ball games require teamwork to complete. However, in the actual physical education process, effective teaching is difficult to achieve due to the quality and skills of teachers and the guidance of students, and it is easy to cause students' skills to fail to improve. In view of these limitations, this article combs the business logic of basketball teaching based on the heterogeneous grouping algorithm, analyzes the teaching motives of the two groups under different teaching organizations, fully guides students to exert their subjective initiative, enhances students' learning enthusiasm, and improves students' level of basketball skills. Finally, the modified factor algorithm is used to evaluate the basketball teaching process students' evaluation and promote the improvement of basketball teaching. The simulation experiment results prove that the heterogeneous grouping algorithm is effective and can support the intelligent monitoring of basketball teaching action optimization. Students can better grasp the specific teaching form in the organizational form of cooperative teaching and promote the learning, communication, and communication between

students and can more objectively evaluate students' learning effects.

Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The author declares no conflicts of interest.

Acknowledgments

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