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Path Design and Practical Exploration of Students' Core Literacy Cultivation in Physical Education Teaching

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SUMMARY: *This research article proposes a physical education structure that takes the cultivation of students' core competences as the center. This research carries out a comparative teaching experiment by taking two basketball elective classes of the 2023 grade in NJ University as the research objects. For the further bettering of teaching content that physical education teachers use, this article designs a time-space obtaining method for basketball movement postures which is on the basis of FSW, which combines BiLSTM and Seq2Seq to establish the BiLSTM-S2S action feature recognition model. It was found that the average recognition rate of the BiLSTM-S2S model on the eight basketball action gestures was 44.54%, The accumulative score of the experiment class students' basketball movement abilities has achieved 78.65±2.12. This score is 71.05% bigger than the score which belongs to the students in the control class. Furthermore, when put into comparison with the control-class students, there existed an obvious promotion in the core abilities of the experimental-class students (P<0.01).*

KEYWORDS: *FSW; BiLSTM; BiLSTM-S2S model; sports education model; sports core literacy*

1 Introduction

In the time period of 21st century, which has the feature of fast development of globalization and digital time, education reform has gradually appeared as the core part for improving education quality and cultivating innovation-type persons [1].One important education transformation in China, the carry out of the new curriculum standard, is planned to cultivate students' core abilities to meet the demands of coming social development, which also marks a shift in the focus of education from single-knowledge inculcation to comprehensive ability cultivation [2-4]. The curriculum which has got new design puts stress on the cultivation of students' basic abilities, which include analytic thought, creation ability, and cooperation work. This change not only promotes the renewal of educational thought, but also brings about innovation in the practice of education. In the epoch of global linkage and electronic transformation, it acts as an important cornerstone for cultivating capable persons [5]. In the middle of these documents, the Physical Education and Health Curriculum Standards for Compulsory Education (2022 Edition) actively faces the demands which come from this present era. This document emphasizes the significance of core abilities in this discipline, thus it puts forward a group of concrete teaching methods and ways. This offers theory support and actual

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push strength for the physical education that reform carries out[6]. Therefore, thus it is necessary that in-depth explorations be conducted on the current core capability cultivation that exists inside physical education subject areas. Furthermore, it is of great necessity to investigate a scientific and effective training method to satisfy the urgent demands for students' comprehensive development.

The concept of core literacy was initially proposed by the International Organization for Economic Cooperation and Development (OECD), which believes that core literacy is the key literacy for every individual in society to be able to live successfully, adapt to work and promote social progress in the 21st century [7, 8]. Based on Reference, the United Nations Educational, Scientific and Cultural Organization (UNESCO) has carried out a deep-going investigation into the inner nature of personnel nurturing. This essential attribute relates to the ideal education goals and the methods which can be used to reach these goals[9]. For satisfying the diverse demands of the future society, UNESCO has published a series of strategy plans and policy guiding documents which target at promoting the full development of the core abilities of students in the 21st century.Literature [10] mentions the need to cultivate students with core knowledge, problem-solving skills and correct emotional attitudes necessary for the 21st century, and considers core literacy to be the key to curriculum reform and the basis for the development of curriculum standards. By exploring the core literacy in the curriculum standards of South Korea and Singapore, it aims to provide a practical direction for the future development of curriculum reform in China. Literature [11] believes that the education process consists of teachers and students, and whether the teacher's speech and behavior is standardized will affect the progress and development of students, the attainment of students' core ability levels relies upon the promotion of teachers' core ability levels. In the field of current education, more stress is laid on the level of teachers' core abilities to cultivate more effective development of the teaching group. To sum up, core ability means the necessary characteristics and key abilities that are needed for individual development and society combination. It is a gathering of ability types that come from school-rooted education. The universal nurture in every scholarly field acts as the approach, and it penetrates the whole course of a person’s lifelong growth.

The discipline core literacy and the general core literacy present a relation that includes the partial and the whole, the unique and the universal, also the specific and the abstract. It is the concrete embodiment that the development of students' core accomplishment has[12]. The Education Ministry (MOE) clearly gives the definition that disciplinary core literacy is the correct values, necessary characters, and key abilities which students gradually obtain through the study of disciplines. This concept is what the core of discipline education values manifests [13, 14]. Literature [15] has emphasized the non-replaceable property of physical education cultivation quality in the comprehensive development of students. Through the deep integration of core literacy and subject teaching, it is constructed that a multi-angle ability promotion framework for students. This framework not merely pays attention to the spread of knowledge but also puts stress on the cultivation of abilities. Therefore, it thus builds a firm foundation for students' whole-life study and long-term continuous development.Reference [16] has carried out comprehensive elaboration regarding the conception of body self-esteem. It is considered by people to be the important constituent part of the core abilities in the physical education discipline. Furthermore, it thus points out that a universal problem among students is the lack of body self-respect. This research puts emphasis on that, the quest for body self-respect is an inherent right which each student has. This chase acts as the base for one person’s sound growth and is an important method of nurturing an affirmative self-identification.The core accomplishment of physical education is one of the constituent subjects among disciplinary core accomplishment. At present, academic circle have not yet obtained an unanimous

agreement on the definition of the physical education core literacy concept.

Literature [17] believes that the teaching practice ability of physical education teachers is an important part of curriculum reform, emphasizing that teachers should have comprehensive and professional core teaching literacy as a prerequisite and foundation for cultivating students' core literacy in physical education. Literature [18] puts forward the view that the discipline of physical education can be used to bring up students' fine individual characters and abilities of social cooperation, hence promoting the formation of correct values and worldviews in students. In the country of Australia, the core abilities in physical education are divided into three basic fields: individual character, body health condition, and other fundamental aspects.In one overall summary, the existing documents show that most teaching experiments have been carried out on students of middle school and high school [19]. This therefore is probably caused by the difficulties which are related to pushing forward the development of physical literacy on the stage of elementary school. Notwithstanding, it is of great necessity to strengthen research work on the stage of primary school. This therefore can let us hold the cognition of the effect of diverse teaching modes in the initial phases of education.Literature [20] has carried out deep research on the method of cultivating the basic qualities of physical education under the big data and Internet of Things framework. People have pointed out that participating in school sport activities can promote students' body health, from body aspect and mind aspect, and promote the forming of long-term movement habits. Nevertheless, students have the manifestation of insufficient enthusiasm in the participation of physical education classes, and thus guarantee does not exist for their exercise time.The author of Reference has carried out a comparison and a summarization of current researches on the movement education model. It showed that there is much proof pointing out that utilizing the movement education mode in physical education can greatly promote students' achievement in many different aspects, which include cognitive, physical, emotional, social, and literacy fields [21]. Nevertheless, it furthermore pointed out the potential negative points of this model. One such insufficiency is that the carrying out of the movement education model needs a prolonged time span. Additionally, students possibly do not show satisfying accomplishment during the teaching instruction stage.Document [22] points out that in the process of pushing forward the reform of quality-oriented education, the current physical education should put stress on the cultivation of students' core physical literacy. This development has very important meaning for promoting the whole crowd's body health and helping the realization of the lifelong physical education goal. Cultivating core physical literacy not only has the contribution to the promotion of the country's people's health but also improves the country's people's physical constitution structure.Literature [23] holds that the school, as a key constituent part of the educational system and having relatively complete manpower resources and material facilities, therefore provides a special platform for carrying out programs that target the cultivation of students' core competencies in physical education. Therefore, hence, this gives forward the suggestion that sports games should be integrated into the instruction of physical education. This method is not only a practice undertaking that explores creative teaching methods, but also an important channel for fostering the core abilities inside the physical education subject.

This research paper has developed a physical education teaching method which is based on the movement education framework. The main goal was to make students' basic physical education ability obtain very big promotion. For carrying out the teaching experiments, students of the 2023 grade in NJ University were selected to be the research participants. A BiLSTM-S2S model was also designed in combination with deep learning technology for the recognition of students' movement features in physical education teaching in order to help teachers optimize the implementation of physical education teaching.

2 A model of physical education and sport oriented to the core literacies

The so-called core ability belongs to the characteristics and abilities which students should have in order to can adapt to the development of society and realize their own long-term personal growth when the society is moving forward. Under the illumination of this newly emerged concept and educational view, educators who teach students ought to carry out modification on the existing physical education teaching model. They ought to put stress on cultivating students' consciousness of problems to achieve the goal that current education has. The teaching of physical education should be made according to the basic requirements of physical education core competencies. This method is for exposing the attraction of sports and cultivating students' consciousness of solidarity, cooperation spirit, initiative mindset, and unyielding will.

2.1 Connotations and Characteristics of the Sport Education Model

2.1.1 Conceptualization of the sport education model

The sports education frame is established on the basic rules of game-centered teaching and game-connected theories. In current sports, competitions occupy an important position and are regarded as a special education tool which possesses huge potential and value. The movement education model was built in the 1980s, during which time movement education theory began to be applied in practical courses and evolved on the basis of inductive summaries of practice. It emphasizes students' autonomous participation in the whole process of athletic training, and encourages each student to reach his or her maximum potential to complete the task or achieve the best performance.

The movement education frame work is a curriculum and teaching mode designed to provide students in physical education classes a real and pleasant learning experience during sports, dance, and exercise activities. This method for the teaching and studying of physical education is one that is guided by educators. This method depends on direct instructors' instruction, cooperative students' study, and is organized through special teams, role-playing based on characters, and competitions. By these methods, it gives real satisfying sport experiences to students no matter what their sport ability levels are. The Movement Education Model of teaching aims to educate students in the truest sense of the word and to help them become competent, sports-literate, and sports-enthusiastic individuals, enhancing students' core physical education skills.

2.1.2 Characteristics of the Movement Education Model

The characteristics of the sport education model are divided into six areas, the details of which are shown in Figure 1: the sport season, the team league group, the official competition, the final competition, the record of results, and the celebration.

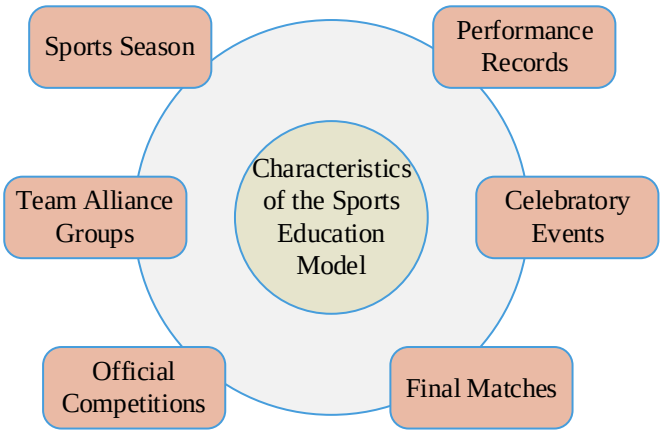

Figure 1: Characteristics of the sports education model

(1) Sport Season. The frame of sport education appoints the teaching unit to be the sport competition period. This present season it contains several different stages. Firstly, there exists a stage in which students carry out practice for the construction of skills. After this step, there exists a pre-competition preparation stage, in which students make preparations for the competition that is about to come. Then, there enters the stage of official competition. At last, one phase that comes after the regular season exists. The time length of this movement competitive period is normally two to three times larger than the time length of the teaching unit inside the traditional physical education pattern.

(2) In the period of sports competition time, students hold the choice to organize study groups. They may at their own decision arrange themselves into groups, or under the instruction of the physical education teacher, hence be divided into teams on the basis of the sport abilities of different groups, and students within the group establish study groups (team alliances), utilizing a cooperative learning model to study in fixed group groups.

(3) Formal competition. After students have learned and mastered the basic skills and tactics, team competitions are held according to the schedule and in accordance with the organizational form of formal competitions. Let the students really experience the competition atmosphere of the formal competition, and act as the planner, organizer and service provider in the formal competition, but also need to as a team member to win the competition and continue to learn and progress.

(4) Final competition. The arrangement of the work in the final competition requires the teacher to determine the arrangement of the work in the final competition based on the performance of the students in their previous roles in the classroom, especially the referee's work and record keeping work, which are related to the fairness and impartiality of the competition.

(5) Record of results. In the sports education model, the form and content of performance records are diversified, mainly by the group recorders are responsible for recording the group's performance in the regular class and on the field of play. Recorded results are submitted to the teacher and also shared with group members, which enables the teacher to understand the students' classroom performance in a timely manner, and also helps to provide timely feedback from individuals or teams within the group, so that the students can see their real performance and make timely and effective adjustments.

(6) Celebration activities. Celebration activities are at the end of the final part of the season, is designed and organized by all teachers and students in the class a post-game relaxation and celebration activities, different students take on different responsibilities to create a festive

atmosphere, for the championship and runner-up competition shouting and cheering.

2.2 Instructional design of the movement education model

2.2.1 Selection of research subjects

The core of this experiment lies in the integration of the movement education model into the carrying out of the education and teaching plan for basketball physical education classes in ordinary universities. In the process of experiment, strict controlling will be carried out on many different aspects, which include the experiment parameters, the surrounding environment, the teachers, and the teaching blueprints. After the experiment ends, a comparison of the results will be carried out to assess the effect of the physical education teaching plan in common universities within the system of the movement education model. This experiment selected two basketball class option classes of NJ University undergraduate class 2023, and the teaching time was one semester from September 2023 to January 2024, with a total of 20 weeks and 40 hours, and the location was the basketball gym on the third floor of the sports center of NJ University. The experimental class (LQ1) was 50 students (27 males and 23 females) and the control class (LQ2) was 48 students (29 males and 19 females). Through the pre-screening of the experimental subjects, all the participating students did not have any experience in participating in professional sports.

The two basketball option classes at NJ University were used as teaching experimental subjects, and the teaching program of basketball option classes in general colleges and universities under the sports education model was applied with the intention of cultivating sports participants with sports enthusiasm, sports ability, and sports literacy. The experiment is intended to reflect changes in athletic ability through the students' progress in basketball skills and specialized physical fitness, changes in athletic literacy through the acquisition of basketball competition rules and theoretical knowledge, refereeing law, and court etiquette, and changes in athletic enthusiasm through the students' changes in motivation, initiative, and interest in participating in basketball exercise.

2.2.2 Design of teaching experiments

(1) Before we carried out the experiment, the student pupils coming from the two classes had undergone assessments with respect to their study enthusiasm, basic basketball-learning abilities, and also the teaching method. This step was taken in order to confirm that no obvious differences exist in the starting states of the experiment's participating people, and therefore to ensure the experiment can carry out in a smooth way.

(2) Independent variables. Traditional teaching mode and sports education mode, that is, the experimental class adopts the sports education mode to carry out basketball teaching, while the control class carries out the traditional teaching mode to teach the ball watching course.

(3) Dependent variable. It mainly includes students' interest in learning basketball sports courses, basketball-specific skills and satisfaction with the teaching mode.

(4) Experimental control. The teaching hours of the experimental class and the control class were kept at 40 hours, and the teaching conditions and the teaching environment were kept the same.

2.2.3 Course instructional design

The sports education model makes the concept that an instructional circle is a sports season, which is divided into four different stages: the training stage, the before-competition stage, the formal competition stage, and the after-competition stage. Just like what is shown in Figure 2, the carrying out of the sport education model can be looked at from two angles: the preparation

stage of the sports season and the carrying out stage of the sports season.

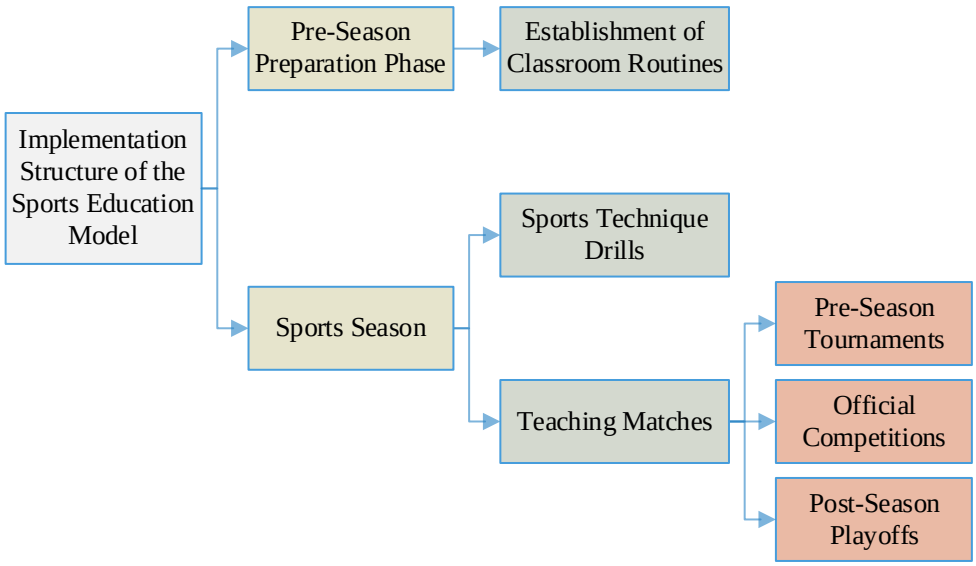

Figure 2: Implementation structure of sports education model

Teaching routines are highly related to the quality of teaching, the teacher should carefully prepare the lesson to be familiar with the flow of each lesson, and the coach of each group should be clear about the content of each practice session, and carefully design the practice content and arrange the role and responsibility of the players, this article concerns the successful completion of the movement education model in the teaching process of basketball courses for students majoring in physical education.

Early in the sports season, more time is spent at the beginning of the lesson, emphasizing the classroom routines while also explaining the classroom roles with their corresponding responsibilities, so the lesson preparation time will be longer. The instructor spends half of the class time on technique and group practice, so the early part of the season is focused on technique and practice, supplemented by familiarity with and mastery of the Sport Education Model class format. In the middle of the season, the time for reviewing skills and tactics and practicing in small groups is lengthened, the time for teacher instruction is shortened, and the time for games is increased to twenty minutes, with most of the games being three-on-three matchups within the group. With the improvement of students' learning ability and athletic level, students' independent study time becomes longer in the late season, and the game and review of skills and tactics take up a large part of the whole class, the game is upgraded from intra-group confrontation to inter-group confrontation, and the form of the game is slowly transitioned from three-on-three to five-on-five, which improves the students' ability of utilizing the skills and tactics of basketball in the process of the game.

The unit teaching plan is the refinement and decomposition of the level plan, is the basic unit of the overall objectives of the curriculum, and plays an important role in physical education. The existence of the unit teaching plan is crucial to both the skill mastery teaching mode and the movement education mode, whether it is teaching basketball or other programs. This is because the unit lesson plan is the code that guides the teacher in the lesson and plays a key role in controlling the teaching progress.

2.2.4 Questionnaire design

In the background of core abilities and study achievement inside physical education and sport

teaching, this study used a questionnaire to follow the development changes among students who accept different teaching methods. With regard to the core abilities of students in physical education and athletic activities, these are mainly assessed through four different aspects:learning interest, affective cooperation, healthy behavior, and physical integrity. Regarding students' satisfaction with the teaching mode, it was mainly quantified from six dimensions: teaching atmosphere, teaching content, teachers' teaching ability, peer relationship, field equipment, and performance evaluation. The questionnaires were all based on a five-point Likert scale, i.e., 1~5 indicates very non-compliant, non-compliant, average, compliant and very compliant, respectively.

For the students' physical education core literacy scale, its reliability and validity test showed that the structural validity analysis of each question item had common factors, and the four dimensions had a significant moderate correlation with each other ($P<0.01$). The Cronbach's alpha coefficient, that is used for measuring the reliability of internal consistency, has been gotten as 0.947. Furthermore, the alpha coefficient values for every one of the four dimensions all are equal to 0.75, thus indicating that the scale has good reliability and validity. The reliability test of the Student Satisfaction Scale showed a reliability alpha coefficient of 0.951, which was proved by the content validity, structural validity ($P<0.01$), and validity scale validity tests, thus indicating that the scale has good reliability and validity.

3 Recognition model of students' movement characteristics in physical education

Under the concept of core literacy, it is necessary for physical education teachers to change their teaching concepts and teaching modes, focus on the cultivation of students' key literacy, and promote the realization of modern physical education goals. The putting deep-learning technology into physical education lets education workers to more successfully identify students' sport movements. This combination provides dependable support that helps teachers improve their physical education course programs. Therefore, it further promotes the promotion of students' core abilities inside the physical education teaching system.

3.1 BiLSTM with Seq2Seq modeling

3.1.1 BiLSTM modeling

The Long Short-Term Memory Neural Network (LSTM) mainly utilizes three components: input gates, forgetting gates and output gates to control and preserve information. The gate mechanism can pass the information needed by the model and the method consists of a Pointwise multiplication to manipulate a Sigmoid neural network layer.The LSTM has three inputs, which are the input x_t at the current moment, the cell state c_{t-1} at the previous moment and the LSTM output h_{t-1}.The LSTM has two outputs, which are the current moment's cell state c_t and LSTM output h_t.

First, it is decided whether the cell needs to discard the information or not, and this function is realized by applying the forgetting gate, which controls the percentage of the cell state c_{t-1} saved from the previous moment to the current cell state c_t, with the following formula:

$$f_t = \sigma\left(W_f \cdot \left[h_{t-1}, x_t\right] + b_f\right) \tag{1}$$

Next, it is decided what information from the input x_t at the current moment is to be added to the cell state c_t, a sigmoid layer is used to represent the input gate, the updated information is decided, and a tanh layer is used to create a new vector to be added to the cell state with the formula shown below:

$$i_t = \sigma\left(W_i \cdot \left[h_{t-1}, x_t\right] + b_i\right) \tag{2}$$

$$\tilde{c}_t = \tanh\left(W_C \cdot \left[h_{t-1}, x_t\right] + b_C\right) \tag{3}$$

Again, the model multiplies the cell state c_{t-1} at the previous moment with the discarded information f_t to discard the unwanted information. It also uses the current cell state $\tilde{c}_t$ and the added information i_t to add the needed information by multiplying them. The formula is as follows:

$$c_t = f_t * c_{t-1} + i_t * \tilde{c}_t \tag{4}$$

Finally, the output gate is utilized to achieve the final output as shown in the following equation:

$$o_t = \sigma\left(W_o \cdot \left[h_{t-1}, x_t\right] + b_o\right) \tag{5}$$

$$h_t = o_t * \tanh(c_t) \tag{6}$$

The bidirectional long and short term memory neural network (BiLSTM) is constituted by forward and backward long-short-term memory (LSTM) units. The concrete structure of this network is shown in the Figure 3. In this network, the processing of data can be carried out in both the forward direction and the backward direction. When we carry out data processing in the backward direction, we can capture the latent features and patterns of the data which are usually ignored by a common LSTM.

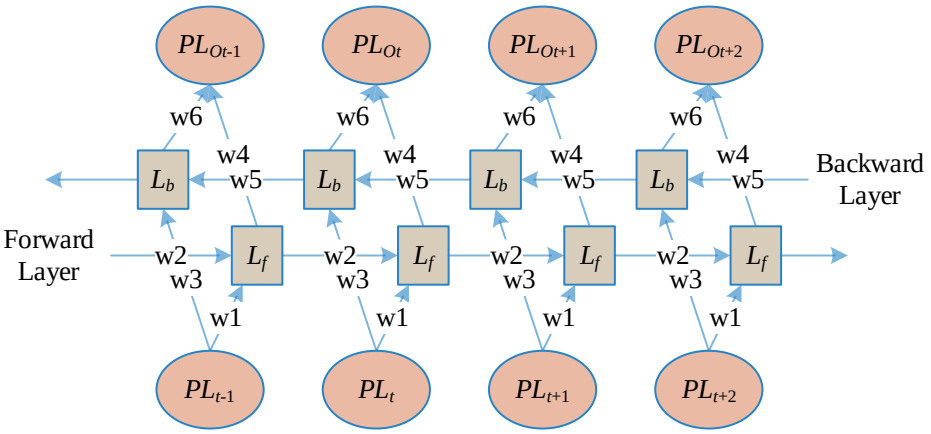

Figure 3: BiLSTM block diagram

The BiLSTM network is used to update the forward hidden layer L_f, the backward hidden

layer L_b and the output sequence $PL_O(t)$ of the network. The network is updated in an iterative manner backward, i.e., from T to 1, and forward, i.e., from 1 to T. The update parameters of the network can be expressed mathematically as:

$$L_f = \sigma\left(W_1 PL_i(t) + W_2 L_f - 1\right) + b_{Lf} \tag{7}$$

$$L_b = \sigma\left(W_3 PL_i(t) + W_5 L_b - 1\right) + b_{Lb} \tag{8}$$

$$PL_O = W_4 L_f + W_6 L + b_{PL_t} \tag{9}$$

where L_f, L_b and PL_O are the forward pass, backward pass and final output layers, respectively, W is the weight coefficient, b_{Lf} and b_{Lb} are both deviations, and σ denotes the Sigmoid function.

3.1.2 The Seq2Seq model

Sequence to Sequence (Seq2Seq) model is used to solve the problem where both input and output are variable length sequences.The Seq2Seq model is an end-to-end network structure that consists of three parts, i.e., the encoder, the decoder, and an intermediate semantic vector connecting the Encoder-Decoder.The Encoder part consists of the neural network units, which input the input sequence into the Encoder to perform encoding operations, forming an intermediate semantic vector that contains all the information of the input sequence, and this vector is passed to the Decoder to get the output sequence. The model uses two neural networks to model the sequence by constructing Encoder and Decoder respectively.

Encoder inputs $X1$, $X2$, $X3$, $X4$, Decoder reads in the vectors encoded by the Encoder, and outputs $Y1$, $Y2$, and when it outputs "<EOS>", it indicates the end of the output of the Decoder.The Encoder and Decoder are the neural network The Encoder and Decoder are the hidden units of the neural network, and the output coding vector C of the last step of the Encoder is used as the input of the first step of the Decoder.

Encoding process: after inputting a text sequence, the last hidden state of a neural network output is retained and encoded into an intermediate semantic vector C which contains the information of the input sequence. Representing the input as a sequence of word vectors $x = (x_1, x_2, \cdots, x_{T_x})$ for each document, the encoding process is:

$$h_t = f\left(x_t, h_{t-1}\right) \tag{10}$$

$$c = q\left(\left\{h_1, h_2, \cdots, h_{T_x}\right\}\right) \tag{11}$$

where h_t is the hidden layer state at the moment t, f is a neural network unit, a variant of RNN, LSTM or GRU, is usually used instead of RNN to avoid problems such as vanishing of RNN gradient, and q is a linear function. The coding vector of the input sentence is used as the last state vector of the encoder, so there:

$$q\left(\left\{h_1, h_2, \cdots, h_{T_x}\right\}\right) = h_{T_x} \tag{12}$$

Decoding process: assume that the output sequence is the category label $y = (y_1, \cdots, y_{T_y})$,

and the output at moment t is determined by the previous output and the semantic vector C, and the probability value of the target word is computed for vector C as:

$$P(y)=\prod_{t=1}^{T_y} P(y_t \mid \{y_1,\cdots,y_{t-1}\},c) \tag{13}$$

$$p(y_t \mid \{y_1,\cdots,y_{t-1}\},c)=g(y_{t-1},s_t,c) \tag{14}$$

$$s_t = f(s_{t-1},y_{t-1},s_t,c) \tag{15}$$

where g denotes the LSTM neural network unit and s_t denotes the state of the LSTM hidden layer at moment t.

3.2 BiLSTM-S2S action recognition model

3.2.1 Spatio-temporal feature extraction for action gestures

In the process which carries out recognition of student basketball actions, the motion condition of these actions is a continuous one. Only depending on the human posture information which comes from a single frame picture to decide basketball movement conduct is not dependable. Therefore, thus it is necessary that judgments be made through the integration of pose information within a definite time scope. For solving this problem, this paper proposes an adaptive Frame Sliding Window approach (FSW) which is used to extract basketball movement posture features out from successive frames.

The basic principle of the FSW method is to set up a window with fixed dimension marked as T to keep the basketball movement posture data within a certain time interval. When new data is inputted, it is put on the right-hand side of the window, and the data that originally was on the left-hand side is taken away. The numerical value of parameter T is adjusted in an adaptive way to fit many different kinds of situations.

We may make assumption that in one specific scene, the distance between the photographed human body and the camera is L and the video capture rate is f frames/second.Under the situation of current frame, the movement velocity of the key point on the human body neck may be considered as the movement speed of the human body. We may suppose that the coordinate values of the key point which is on the neck of human body are ith frame be (x_i^{neck}, y_i^{neck}), and the coordinates of the corresponding neck key point of the same human body in the $i-1$th frame be $(x_{i-1}^{neck}, y_{i-1}^{neck})$, then the value of T is defined as:

$$\frac{1}{T}=\frac{KL\sqrt{\left(x_i^{neck}-x_{i-1}^{neck}\right)^2+\left(y_i^{neck}-y_{i-1}^{neck}\right)^2}}{\Delta t} \tag{16}$$

$$\Delta t = 1/f \tag{17}$$

where Δt is the time difference between the ith frame and the $i-1$th frame, and K is ne variable which is connected with the scene, it can be utilized to adjust the influence of L.

The steps of extracting students' basketball action gesture features using FSW are as follows:

(1) Combine the design of spatial features and temporal features of students' basketball

action gestures using a behavioral analysis-based method, and calculate the continuous T frames of gesture information of the same student's basketball action gesture, including the difference in the height of the basketball action, the longitudinal movement speed of the basketball action gesture, the amount of change in the difference in the heights of the neighboring frames, the change in the gap of the height differences of three picture frames, as well as the change in the gap of the height differences of five picture frames.

(2) Carry out calculation and get the maximum and minimum values in the consecutive T frames of pose information which are related to the posture of human body. These numerical values will act as the motion characteristic data that is connected with the pose of human body i frame image, which mainly includes the maximum value of the human body's height difference $h_i^{\max}$, the minimum value of the human body's height difference $h_i^{\min}$, the maximum value of the human body's pose longitudinal motion velocity $v_{i,\max}^b$, the minimum value of longitudinal movement speed of human body posture $v_{i,\min}^b$, the maximum value of the change in height difference of neighboring frames $\Delta h_{i,1}^{\max}$, the minimum value of the change in height difference of neighboring frames $\Delta h_{i,1}^{\min}$, the maximum value of the change in height difference of three frames $\Delta h_{i,3}^{\max}$, the minimum value of three-frame height difference variation $\Delta h_{i,3}^{\min}$, the maximum value of five-frame height difference variation $\Delta h_{i,5}^{\max}$, and the minimum value of five-frame height difference variation $\Delta h_{i,5}^{\min}$.

(3) The above features are fused to form a 10-dimensional human motion attitude feature vector F_i, i.e:

$$F_i = \left(h_i^{\max}, h_i^{\min}, v_{i,\max}^b, v_{i,\min}^b, \Delta h_{i,1}^{\max}, \Delta h_{i,1}^{\min}, \Delta h_{i,3}^{\max}, \Delta h_{i,3}^{\min}, \Delta h_{i,5}^{\max}, \Delta h_{i,5}^{\min} \right) \tag{18}$$

Due to the great variability in the range of values of different features, in this paper, the feature vector is normalized and mapped to the interval from 0 to 1, so as to reduce the error generated by the variability of features. Assuming that the k th feature of F_i is set as F_i^k, $k = 1, 2, ..., 10$, then a normalization operation is performed on it:

$$\bar{F}_i^k = \frac{F_i^k - F_i^{\min}}{F_i^{\max} - F_i^{\min}} \tag{19}$$

where $\bar{F}_i^k$ denotes the student's movement posture feature after F_i^k normalization, $F_i^{\max}$ denotes the feature maximum value before F_i normalization, and $F_i^{\min}$ denotes the feature minimum value before F_i normalization.

3.2.2 BiLSTM-S2S model architecture

After we have obtained the characteristics of students' basketball postures, the adjustment of the Seq2Seq model is done to make it suit the video data. This adjustment has the objective to further promote the accurate extraction of high-level characteristics for the identification of video-connected basketball movements.

The target that the Seq2Seq model needs to reach is to change one sequence which belongs to a language into another sequence which comes from another different language. The whole flow of steps includes that a recurrent neural network is utilized by us to map one input sequence

onto one output sequence. Speak of time-series data, recurrent neural networks usually focus on data that is near and ignore data that is far away. Owing to the fact that the training procedure is connected with the identical output layer, thus each point in the input sequence can be provided to the output layer to complete the past and future contextual information. Finally, the BiLSTM-S2S model is proposed for student basketball action gesture recognition using the BiLSTM model, the specific architecture of which is shown in Fig. 4. The sequence data $\{x_1, x_2, ..., x_n\}$ containing additional features flow as input data in the encoder part of the BiLSTM-S2S, which is then encoded into semantic vectors e that are input to the decoder part. The decoder adopts the output of the previous moment as the additional input of the current moment, and then completes the recognition prediction of the student's basketball action posture.

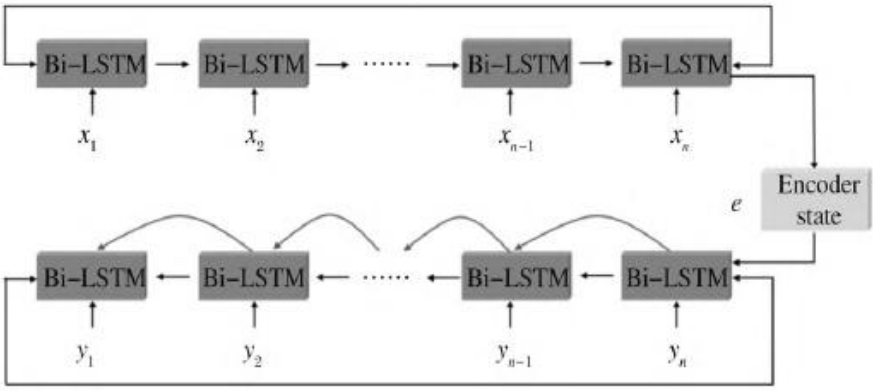

Figure 4: BiLSTM-S2S model architecture

3.3 Recognition Analysis of Students' Basketball Movement Characteristics

3.3.1 Basketball dataset

In the field of deep learning, no research can be done without the support of datasets, whose role is self-evident, and there is no exception in the field of student basketball action recognition. Therefore, in this study, the construction method of basketball movement dataset is firstly analyzed in depth. The videos of students' basketball game scenes in the movement education mode were used as the original data source. By observing and analyzing these videos and exploring the characteristics of students' actions, eight representative basketball actions are summarized and classified as shown in Table 1, including dribbling, free throws, blocking, layups, passing, rebounding, covering, and shooting.

Table 1: Basketball action and behavior instructions

Code	Action	Action note
A1	Dribbling	Running and dribbling the ball with one hand
A2	Free throw	Stand still and hold the ball with both hands
A3	Cover1	Take a step forward and stretch out your arms
A4	Layup	Run and pick up the ball with your hand
A5	Pass ball	Stand still and hold the ball with both hands
A6	Rebound	Jump on the spot and raise both hands high
A7	Cover2	Stand still and straighten your hands
A8	Shooting	Jump in place and hold the ball with both hands

3.3.2 Comparison of Action Recognition Methods

Although some videos about students playing basketball were collected, they are still far from enough for a deep network, all this paper does not train the network from scratch, but pre-trains it based on an existing large basketball dataset and initializes the parameters of the network. Since the classification of actions is the same, for the parameters of the final classification layer, this paper uses a Gaussian distribution for initialization and does not use the parameters of the last layer of the network.

The classified action videos are utilized by us to obtain action features through the BiLSTM - S2S model which is developed in this paper. This procedure produces a series of movement characteristic data, which are then fed into the model that carries out action recognition training. The training process is updated by means of the Adam optimizer, with an initial learning rate which is set at 0.005. The training is carried out by means of 1000 times of repeated computation iteration. When the process comes to the 300th, 500th, and 800th iteration times, the learning rate is multiplied by 0.2, thus it brings an 80% reduction. In the end, the best model is chosen to carry out testing, hence it can confirm the recognition rates of many different kinds of actions. For verifying the effect of our method in student basketball match video materials, this article builds a contrast between our put-forward method and many action identification methods by using the data collection of this research. The concrete method settings and experiment results are given in Table 2. In the middle of these methods, the BiLSTM-S2S is the model which this paper has developed. Feature-Descriptors is one method which first carries out extraction of video features by means of traditional feature-extraction ways and then carries out action recognition. Deep-LSTM is one technology for action identification which uses one method that is on basis of the combined attention mechanism. Res-TCN is a method for recognizing actions that depends on the convolutional neural network of time domain. These methods are duplicated in accordance with what the original text says. After that, we carry out the migration training, therefore we compare the obtained results with the results of BiLSTM - S2S. The entries that are made bold in the table stand for the best possible results.

As can be seen from the table, although there are some actions (layup A4) whose recognition results are not optimal, overall the BiLSTM-S2S model designed in this paper accurately recognizes most of the action results in the comparison test group.The average recognition rate of the BiLSTM-S2S model on the eight basketball action postures is 44.54%, which is higher than that of the Feature- Descriptors, Deep-LSTM and Res-TCN models with mean values of 21.41%, 22.47% and 15.51% respectively. Therefore, it can be shown that after obtaining the spatio-temporal features of students' basketball movements in this paper, it has the possibility that BiLSTM and Seq2Seq models can be incorporated into the work of basketball movement recognition. This merging can set up a foundation for teachers to improve the content of physical education teaching and raise the level of students' basketball movement skills.

Table 2: Test results using different methods of action recognition/%

Action	Feature-Descriptors	Deep-LSTM	Res-TCN	BiLSTM-S2S
A1	24.35	21.25	25.34	**40.41**
A2	14.27	23.78	28.76	**43.94**
A3	39.36	47.64	49.34	**76.83**
A4	**42.18**	5.31	10.52	13.52
A5	13.05	17.36	30.41	**48.79**
A6	11.74	14.72	19.15	**29.34**
A7	16.63	22.18	38.82	**56.57**
A8	23.49	24.34	29.86	**46.91**
Means	23.13	22.07	29.03	**44.54**

3.3.3 Model ablation experiment results

In this paper, the ablation experiments are conducted based on the worse viewpoint evaluation of student basketball game videos established in the previous paper, and the basketball action recognition results of BiLSTM, Seq2Seq and BiLSTM-S2S are verified respectively, and their specific results are shown in Fig. 5. Where CV, CO, and CP denote the student basketball action recognition accuracy of different models under cross-validation, cross-object, and cross-view, respectively.

The results show that compared with the original BiLSTM and Seq2Seq models, the BiLSTM-S2S model based on basketball action features makes full use of the relative positions of the basketball and the player on the basis of extracting students' basketball movement features, and its overall basketball action recognition rate is higher.The cross-validation, cross-object and cross-view angle action recognition accuracies of the BiLSTM-S2S model are respectively were 86.76%, 83.62% and 86.57%, which were 12.31%, 7.11% and 7.68% higher compared to the BiLSTM model, and 13.48%, 6.13% and 8.54% higher compared to the Seq2Seq model. As a result, it is proved that a single network model cannot effectively cope with the complex basketball game environment, and after introducing behavioral analysis for feature extraction, the BiLSTM-S2S model can better describe the action postures of the students' basketball game, while the model learning performance is also significantly optimized.

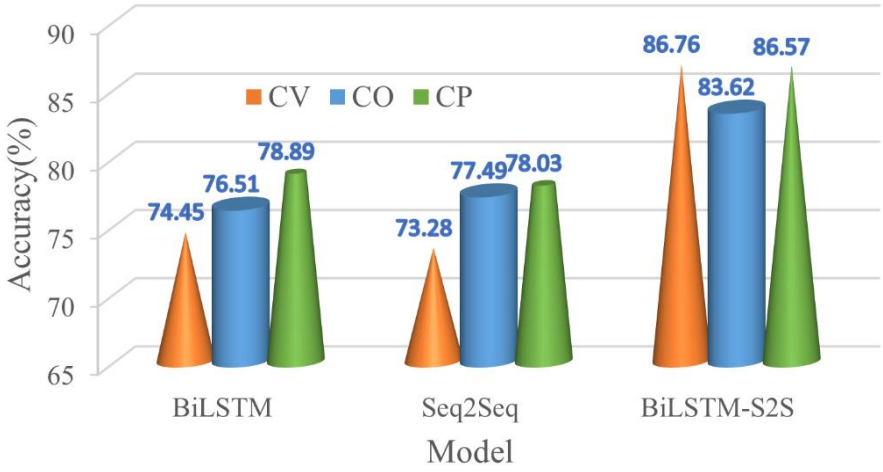

Figure 5: The accuracy rate of student basketball action recognition

4 Empirical analysis of students' core literacy in physical education teaching

The teaching method is the core of physical education teaching, and is a very important carrier for ensuring the smooth carrying out of teaching work. It directly decides and influences the teaching results inside the physical education classroom.Under the frame of core accomplishment, although a number of changes have been done to physical education teaching ways and the teaching content has got more overall, in the real course of physical education class teaching, teachers still limit physical education teaching methods inside the textbooks. Therefore, hence, it is very necessary for us to carry out further probing into new paths for physical education teaching, so as to effectively promote the core literacy of students.

4.1 Validation of the effectiveness of the physical education and sport model

4.1.1 Basketball motor skills test

For students' basketball motor skills, this paper mainly tests three dimensions: passing, dribbling and shooting. Before the beginning of the teaching experiment, the basketball motor skills of the students in the two classes were tested and the independent sample t-test was conducted using SPSS software, and its specific results are shown in Table 3.

The results got from the test show that the total marks of the students in the experiment class before the experiment (24.79±2.06) and those of the students in the contrast class (24.92±1.98) are on a comparatively low level. Regarding the total scores that these two groups of students have obtained, the t-value is -0.486, and the P-value is 0.726, which is larger than 0.05. This indicates that before the experiment carry out, there is no obvious difference between two class students' total basketball motor skill overall scores. Furthermore, before we carry out the experiment, there existed no obvious difference ($P > 0.05$) between the student scores of the experimental group and the student scores of the control group in the three aspects of dribble, pass and shoot. Because of this reason, therefore, it is suitable that these groups be utilized by us for teaching experiments.

Table 3: Test of basketball skills before experiment

Item	LQ1	LQ2	*t*	*P*
Passing	4.51±2.47	4.48±2.51	-0.074	0.634
Dribbling	8.32±3.15	8.43±2.76	-0.196	0.169
Shooting	11.96±1.78	12.01±1.63	0.751	0.318
Total	24.79±2.06	24.92±1.98	-0.486	0.726

Note: $P>0.05$ indicates no significant difference, $P<0.05$ and $P<0.01$ indicate significant and highly significant differences, respectively, as follows.

After the teaching experiment has been finished, the basketball movement abilities of the students of the two classes were tested again. After that, the test results were analyzed through an independent sample t-test which used SPSS software. The outcomes of this experiment are put in Table 4.

The research results show that the total score of the basketball movement abilities of the students in the experiment class (78.65±2.12) is obviously higher than that of the students in the comparison class (45.98±3.69). Furthermore, regarding the total score of the basketball movement abilities of the students in the two classes, the t-value is 4.352, and the P-value is 0.002, hence it is smaller than 0.01, which means that the difference of the total score of basketball motor skills of the students of the two classes is very significant. In addition, for each skill of dribbling, passing and shooting, students in the experimental class scored significantly higher than the control class, and the test results also showed a highly significant difference ($P<0.01$). Therefore, the use of the educational model in teaching sports basketball skills is more favorable to the development of students and can significantly enhance the level of students' basketball skills.

Table 4: Test of basketball skills after experiment

Item	LQ1	LQ2	*t*	*P*
Passing	24.02±5.78	13.16±4.93	4.793	0.003
Dribbling	26.39±1.24	11.04±5.19	3.587	0.000
Shooting	28.24±3.58	21.78±4.06	9.178	0.001
Total	78.65±2.12	45.98±3.69	4.352	0.002

4.1.2 Changes in core student qualifications

With regard to students' core ability qualities in physical education course, the experimental examination measurement targets are constituted of four aspects: study enthusiasm, emotion cooperation, healthful behaviors and body healthy state. For the purpose of distinguishing the difference in performance between the two groups of students after the experiment, the mean value, standard deviation, and independent sample t-test numerical values (t-value and P-value) are utilized. The Core Ability Investigation Tool is employed by researchers to collect data about the above-mentioned four targets. After that, we carry out analysis on the results, hence we confirm the differences which exist in the two groups of students' study motivation for physical education when the experimental time period is over, the differences in their social adaptability and the differences in their cooperation and communication ability in the dimension of mental health, the differences in their environmental adaptability in the dimension of physical and mental health, and the differences in changes in conscious health behaviors and changes in the spiritual qualities of physical education. The changes of the students' core accomplishment in the two classes after the experiment are showed in Table 5.

From the statistics in the table, it can be seen that through the experiment, the P-value of the test results of the control class and the experimental class concerning the two items of learning interest and affective performance is lower than 0.01, and there is a very significant difference in the data. It shows that there is a big difference between the two groups of students in the two teaching modes in terms of learning interest and emotional expression, and the degree of cooperation is also obviously different. It can be learned through the results of the experimental data that the movement teaching mode can effectively stimulate students' interest in learning, improve students' ability to express their emotions and the ability to work in a team, and it is more advantageous in the promotion of the comprehensive quality of students' competence as compared with the traditional mode of teaching. From the perspective of educational psychology, the sports education model adopted for the experimental class is more conducive to the cultivation of students' interest in learning. The sports education model enhances students' participation in the classroom through games and grouping, mobilizes their interest in learning, and promotes the students' desire and interest in independent learning under the influence of positive psychological factors such as the sense of collective honor, the sense of participation, and the sense of belonging.

Furthermore, under the influence coming from the sports education model, the experimental class has shown a significantly bigger learning enthusiasm when we compare it with the control class, and they also possess a higher degree of classroom participation. At the same time, because of the influence of special course factors including group study, group construction activities and sports matches, after the experimental class finished team grouping, the students have formed a nearer type of team cooperation between group members and with the people who are around them, but also in this teamwork effectively develop team tacit understanding and teamwork psychology. On this basis, more cooperation was carried out, and a sense of team trust and belonging was thus established, which also led to the data on affective cooperation in the experimental class was also much higher than that in the control class.Furthermore,

according to the data shown in the table, we can see that the P-value of the results got from the health behavior and body feature assessment of both the experiment group and the comparison group after the experiment is smaller than 0.01, and the data show significant differences. From the perspective of exercise physiology, the experimental class pays more attention to the principle of individual differentiation of students under the teaching mode of exercise education model, and conducts team grouping according to the specific conditions of students. At the same time, the specific forms of teamwork and sports games are used to enhance the students' exercise load, which is in line with the principle of overload in exercise physiology, and gradually enhances the students' health behaviors and physical fitness. The control group, on the other hand, lacked individual differences, and the unified instruction did not adapt well to the individualized differences of students under the premise of average educational resources. There were large differences in physical and mental health and basic sports ethics between the two groups under the two modes of teaching, and the exercise education model was more advantageous than the traditional teaching model in improving students' physical and mental health and basic sports ethics.

Table 5: The changes in students' core literacy

Index	LQ1	LQ2	*t*	*P*
Learning interest	4.63±0.81	2.75±0.86	5.372	0.001
Emotional cooperation	4.59±0.79	2.87±0.75	7.618	0.005
Healthy behavior	4.31±0.92	2.63±0.62	4.051	0.000
Sports ethics	4.48±0.64	2.79±0.59	6.749	0.002

4.1.3 Satisfaction with the teaching model

Before the experiment, one long-term evaluation was conducted by us to compare the satisfaction degree of students toward the physical education teaching method between the control group which uses traditional teaching and the experimental group. The goal of this comparison is to find out differences in students' satisfaction of physical education courses between the two groups when any other teaching method intervention does not exist. Figure 6 gives the pre-experiment contrast of the students' degree of satisfaction toward the physical education teaching model in the two groups.

According to the investigation and statistics evaluation, it is thus clear that before the experiment was carried out, there existed no obvious difference in the satisfaction degree of students between the experiment class and the contrast class on the physical education teaching method. Before the experiment carry out, in the experiment class and the contrast class, 18.34 percent and 16.55 percent of the students, separately, expressed high degree satisfaction toward the physical education teaching method. At the same time, 9.58 percent and 9.24 percent of the students in these two classes, in corresponding order, stated they held strong discontent toward the physical education teaching method. Overall, the students' learning satisfaction with the physical education teaching mode in the two classes before the experiment was basically comparable, and most of them showed an intermediate attitude, considering it slightly satisfied or average, and not too many students considered it extremely satisfied or extremely dissatisfied.

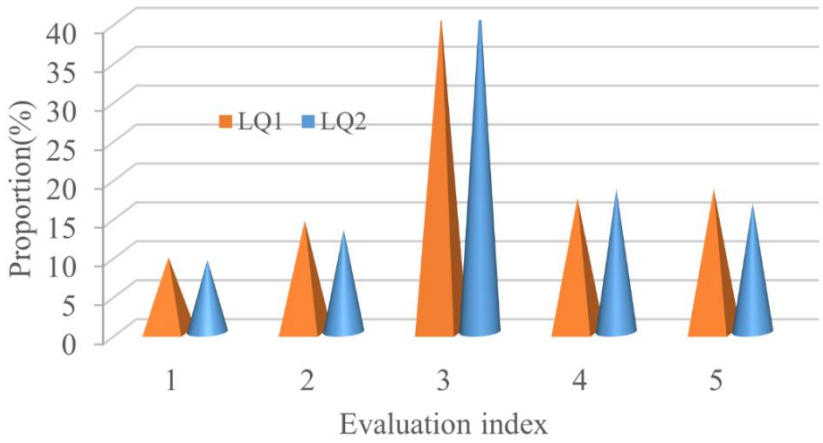

Figure 6: Pre-experiment of physical education model satisfaction

After the teaching experiment finished, a later-stage evaluation was conducted to measure the two classes' students' satisfaction toward the physical education teaching model. The comparison outcomes of this evaluation are displayed in Figure 7.According to the results got from the questionnaire and statistics analysis, it is very clear that after the movement education model has been put into use in the physical education basketball class, students' attitudes toward the physical education classes have had a big change. It is worth pointing out that, the biggest change that can be clearly seen was found in the experiment class.After the experiment, an obvious 26.61% of the students in the experiment class said they have high degrees of satisfaction with the physical education classes. By comparison, merely 16.55 percent of the students who are in the control class have expressed similar high-level satisfaction. With respect to the dissatisfaction condition, only 3.62 percent of students who are in the experimental class have expressed that they hold a high degree of dissatisfaction. On another hand, the percentage of students with extreme dissatisfaction in the control class has risen to 9.24%. On the whole, after the completion of the experiment, the students who are in the experimental class possess a higher degree of learning satisfaction. To speak specifically, the quantity of students that hold high contentment toward physical education courses in the experiment class is 1.61 times larger than that which is in the contrast class. Furthermore, the percentage of students who hold a positive opinion on physical education courses in the experiment group is over ten percentage points higher than the percentage in the comparison group. In the experiment class, only an extremely small quantity of students hold that physical education classes are not good or are not satisfying. By comparison, the condition which appears in the control class is not the same. Quite a big portion of students who are in the control class still hold the view that physical education classes are of ordinary level or not satisfying.

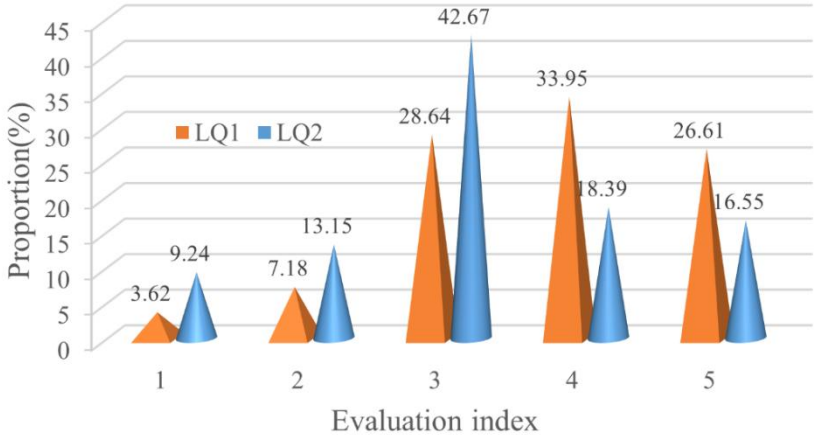

Figure 7: Post-experiment of physical education model satisfaction

4.2 Optimization of the core training path for student sports

4.2.1 Using games to teach and enhance fun

Interest is the motivation for students to actively construct knowledge, and in the process of teaching sports to students, teachers should also realize that only when students are enthusiastic and passionate about sports will they actively expend their energy on the construction of sports and gradually complete the learning of sports skills. Therefore, in the current teaching of physical education courses, teachers should also introduce games into the teaching, so that students have a positive interest in sports learning, so that teachers can facilitate the effective guidance of students, and promote the development of students' sports core qualities.

In the case of basketball, teachers can use games to further enhance students' motivation to exercise and improve their physical fitness. In the classroom, the teacher first explains to the students what they should pay attention to in the process of basketball. Then, the teacher sets up jumping hoops, grabbing the ball, jumping bamboo poles and other games, and explains the rules of each game to the students. After that, the teacher organizes the students to combine their own interests and pick the games that match their interests, so that they can gradually exercise their cardiorespiratory function and body coordination in the process of participating in the games on their own. In addition, the form of the game can also guarantee the students' attention to participate in physical education courses, so that the students in the process of playing games for a long time, to enhance their own endurance, in order to better participate in sports practice, to improve the level of students' sports skills.

4.2.2 Strengthening the nurturing role of the physical education curriculum

The physical education teaching activities should be carried out in a systematized manner. Core accomplishment is the directional demand that the curriculum reform puts forward, and it is also the key emphasis of present physical education curriculum teaching. Teachers ought to put stress on the cultivation of sportsmanship, in which place the value of physical education is comprehensively embodied. For the cultivation of students' core literacy, the utilization of diversified physical education teaching resources is a thing which is necessary. In every different stage of teaching guidance, teachers must carry out refinement on teaching goals, complete a detailed classification work of physical education teaching in a step-by-step way, and at the same time consider the different sports and exercise demands of students. The goal is to promote every student to actively participate in physical training and exercise. For example, in the situation of basketball, a deeply loved sport, teachers are required to clearly put forward

the educational goal and emphasize the nurturing of students' athletic spirit. That is to say, not only let the students master basketball, but also in the practice of exercise to obtain healthy development, build students' sports character.

Teachers should set the goal of educating people in stages, and pay attention to the coordination between class time and course content in each semester and school year. Especially when students have different levels of physical activity, teachers should emphasize the focus of curriculum teaching to make the teaching content more targeted and effective. In addition, teachers should pay attention to the articulation of the educational objectives of each stage. So that students can participate in practical exploration in class or out of class, gradually improve their own exercise initiative and enthusiasm, and enhance their exercise ability in repeated practice and exploration.

5 Conclusion

The cultivation and continuous improvement of students' core literacy is related to their future learning, career development and the realization of their personal ideals. For this reason, this study proposes a sports education teaching model oriented to students' core literacy and combines deep learning technology to acquire students' movements during sports to help teachers better optimize their sports teaching programs. It was found that the average recognition rate of BiLSTM-S2S model on eight basketball action postures was 44.54%, the total score of basketball motor skills of students in the experimental class was significantly higher than that of the control class, the change of students' core literacy possessed a very significant difference ($P<0.01$), and the satisfaction of the experimental class with the sports education model was significantly higher than that of the control class. Therefore, in the carrying out of physical education class, it is necessary that we fully give consideration to the employment of game-based teaching method. This method can elevate students’ study enthusiasm, thus it can consolidate the education function that physical education curricula have. Through this kind of doing, a firm foundation can be built for the promotion of students' core ability qualities.

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