Curriculum and Teaching Methodology (2023)
Clausius Scientific Press, Canada

DOI: 10.23977/curtm.2023.060914
ISSN 2616-2261 Vol. 6 Num. 9

Exploration of the Teaching Mode of "Online + Offline" in the Course of "Physical Education and Health"

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Keywords: Table tennis; Kinect; Assist in online teaching; Action capture; Technical action extraction; Comparative analysis of the technical actions

Abstract: As the “post-epidemic era” dawns, the spread of the epidemic becomes faster and faster, which has brought great impact on human society and made people's production and life impossible to fully restore. This is in part due to the growth of the epidemic resulting a profound impact on human society and the production, life of the people cannot be fully restored to their original state. “This requires that" online course experience "should not be neglected, but to real-time progress, explore and develop" online + offline "integration of more close, effective teaching mode. In order to improve the quality of online table tennis teaching, improve the deficiencies in traditional offline table tennis teaching, and pursue modern and scientific teaching objectives, this study proposes to design and develop the basic technical action evaluation system of table tennis based on Kinect motion capture technology. In view of the serious decline in the teaching quality of students' physical education at home in the post-epidemic era, the system can give guidance and evaluation to online students to meet the needs of table tennis learners to learn table tennis technical movements independently. First, extract table tennis teachers’ basic technical action, in this study, the table tennis cross-pace is divided into: “Turning right”, “Stepping on the left foot”, “Straightening the body”, three periodic action. According to the Euler distance, calculate the participation of the skeletal joint nodes in the whole period at all the stages of the movement; The three groups of bone joints with high participation of teachers in the same movements are extracted as the technical action comparison and evaluation database. Then, in the action comparison and evaluation analysis module, the Dynamic Time Warping algorithm is used to align the two time series of different lengths, and compare the similarity degree of the two sequences, and evaluate the completeness and accuracy of the overall technical action of the test object by the degree of similarity. The Pearson correlation coefficient is used to calculate the correlation degree of the initial action posture and the ending action posture of the three action stages respectively. According to the calculation results of the correlation degree, the problems existing in a specific technical action in the whole action cycle of the tester can be analyzed and analyzed in detail. By writing a computer program,

realize the student test of table tennis technique action comparison evaluation results analysis function, intelligent feedback charts, text information of quantitative feedback evaluation results, so that students can timely understand the problems of their action, and correct themselves according to the evaluation results, achieve "outbreak era" auxiliary of online sports teaching function and purpose.

1. Disadvantages of traditional online sports teaching in colleges and universities

An excellent physical education class must make full use of the vitality of the body and mind, in order to get the best results. In addition, online education focuses more on vision, hearing and touch, so "light see, not practice" is not applicable. For example, to master the basic skills of football, you must practice them yourself and constantly so that you can understand every detail deeper. Many sports require the joint efforts of a team, but this situation is difficult to do in the traditional classroom way. The traditional classroom method is usually taught by a single teacher, so it is difficult for students to communicate effectively. Instead, the games involve multiple participants, and there are usually multiple participants fighting against each other[1-2].

2. Design based on Kinect basic technical action evaluation system of table tennis

2.1. Demand analysis of table tennis ball action evaluation system

Detailed analysis of user needs can judge the feasibility of the system development, understand the problems encountered in the project development in advance, and meet the needs of physical education teachers and online learners, as shown in Figure 1.

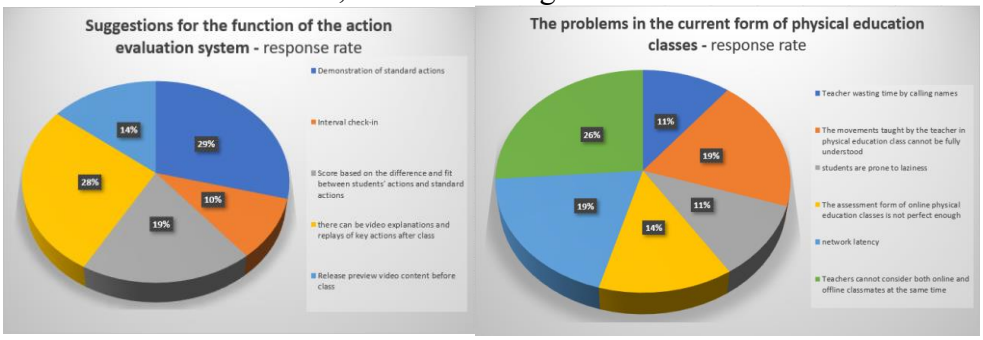

Figure 1: Questionnaire survey result feedback

First of all, the online students' body and mind are generally lazy, during the courses, this loose attitude, which leads to the quality of physical education teaching is greatly reduced.Also, due to the problem of network delay, teachers' offline teaching demonstration becomes fuzzy, which makes it more inconvenient for the students to study and practice. Second, the learning of table tennis technical action itself is the base of table tennis practicing and it is also the key to the practicing.However, due to the traditional table tennis teaching is mostly dependents on the coaches and teachers' demonstration, which is abstract, students in the process of imitation and practising, are difficult to master and found problems and mistakes in their practicing.Once the wrong action becomes a habit, it will take a long time to correct it later on. Finally, due to the limited resources of teachers in universities, coaches or teachers have different understandings of various technical movements of table tennis, and the technical level is uneven, which will also affect the movement

development of table tennis learners to a certain extent. Therefore, it is urgent for an objective, scientific and unified action evaluation standard intelligent system to assist or even replace teachers to complete teaching.

2.2. Functional requirements analysis of table tennis technical action evaluation system

Combined with the development objectives and the above user needs, the basic technical action evaluation system designed and developed in this study should mainly include the following two functions:

① Evaluation and analyze the accuracy and standardization of technical actions made by users;

② Provide users with the technical action model of excellent athletes or professional table tennis teachers;

Therefore, the system functional flow chart of this experimental design is shown in Figure 2:

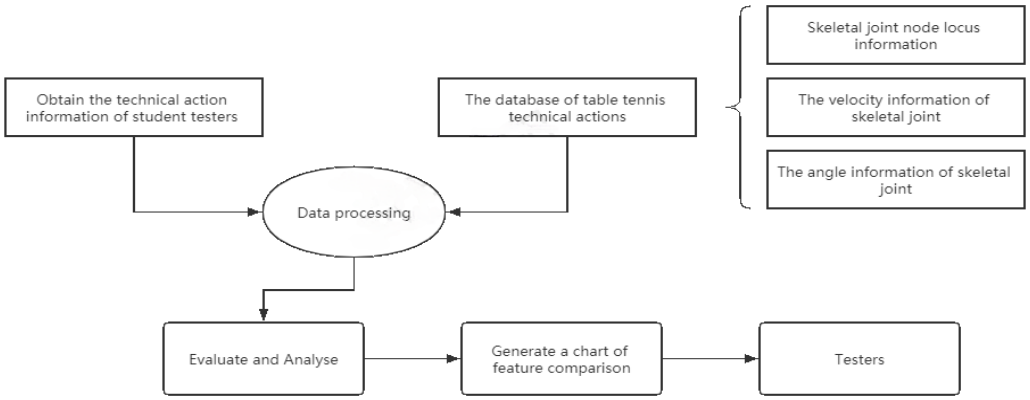

Figure 2: Work flow chart of the basic technical action evaluation system of table tennis

Specific analysis of each function is as follows:

(1) The function of accurately capturing human motion information without wearing a wearable device.

Using the motion capture technology of Kinect depth camera, the tester can obtain technical motion information without wearing any motion sensing device, as shown in Figure 3.

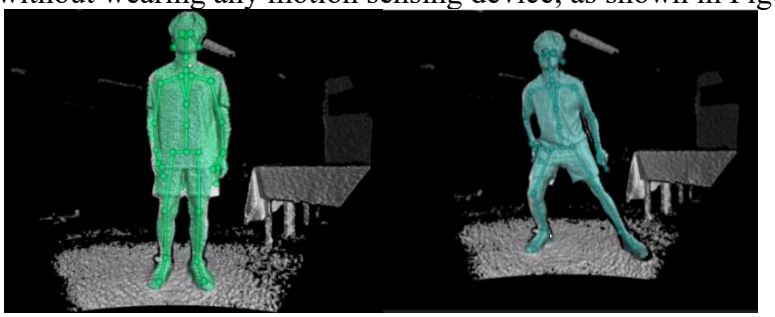

Figure 3: Kinect Obtain skeletal joint nodes

(2) Provide the function of table tennis technical action evaluation and analysis standard.[5]

This experiment needs to extract the characteristics of table tennis technical movements of table tennis teachers or excellent athletes, and take them as the evaluation standard of this system. However, in practice, everyone's table tennis skills more or less there will be some differences, but through the expert teachers, excellent table tennis players access, and access to the relevant information[1] [3] [4] Later, it was found that the correct table tennis technical movements had a high

consistency in the movement track and the order and structure of each joint. This facilitated the technical action acquisition aspect of this study. A Kinect depth camera was used to capture the positional information of 3D nodes of test students. The differences between the initial states and the end states of each technical action were analyzed separately, and the participation degree of each bone node in the table tennis technical action was calculated according to the Eulerian distance calculation formula[3-4].

2.3. Analysis of table tennis technical movements (take table tennis pace as an example)

The footwork of table tennis can be summarized into single step, parallel step, step, cross step, jump step, pad step, small broken step and other seven kinds, among which the first five are the main footwork. In table tennis, both attack and defense have different footwork, the movement of pace is indispensable in the process of competition between the two sides, playing table tennis is a three-point technique, seven-step method, good footwork is a very important link. Flexible footwork and coordination are one of the keys to victory in table tennis competition. Flexible footwork, coordination can make their movement speed, you can adjust the direction and strength of the ball at any time. In the game, we should pay attention to observe the opponent's position and movement characteristics, so as to make fast and slow, soft and strong.

2.4. Table tennis pace movement evaluation and system realization[2]

From the above analysis, we can see that the correct pace of the table tennis ball, the action structure and the completion order of the movement stage are strictly consistent. Beginners or amateurs often ignore the use of pace when playing table tennis, resulting in obvious return mistakes in actual combat.

The technical action evaluation system in this study uses dynamic time planning algorithm to analyze the pace movements of test subjects and elite athletes. Pearson's correlation coefficient was used to compare the participation of the three states of the test objects and the pace of the excellent athletes. According to the calculated correlation coefficient, it analyzes and points out the specific problems that should be corrected and improved.

2.4.1 Dynamic time planning[2]

Time series of 3D position information of human skeletal joint nodes at a data acquisition frame rate of 30 frames/s. Since the time for each person to complete a pace cycle is different, it is necessary to evaluate the standard degree of the tester to process the time series data of different tester, and then compare with the time series of the standard technical action so as to analyze the degree of similarity of the two time series.

This system adopts the dynamic time planning algorithm to stretch and shorten the corresponding length of the time series data of the test object, so as to ensure the consistency of the length of the two sequences to the maximum extent, and judge the similarity degree of the corresponding frame matching, so as to evaluate the technical action as a whole[5].

The calculation principle of dynamic time planning is as follows: set the time series of testers and the time series of excellent athletes respectively $T=(T_1, T_2, T_3, ..., T_k)$、$E=(E_1, E_2, E_3, ..., E_P)$, the length are k and p, respectively. The normalized path is $W= (W_1, W_2, W_3, ..., W_h)$, thereinto，$W_h=(i, j)_h$, $Max(k, p) \leq h \leq k+p$.By constructing a k×p grid matrix for aligning T and E, each grid point (i, j) corresponds to the distance between T_i and E_j $d(T_i, E_j)$. Using Euclidean distance representation, smaller distance and higher similarity. The normalized path shall meet the following constraints:

(1) Border condition: $W_1=(1, 1)$, $W_h=(k, p)$
(2) Continuity: if $W_{h-1}= (A ', b')$, then Wk = (a, b), a-a '1, b-b' 1.
(3) Monotonicity: no simultaneous occurrence of a-a '=1, b-b' =1.

2.4.2 Pearson correlation analysis

This section is aimed at the differences in the range of steps caused by the different body shapes of the different test subjects.

We used the Pearson correlation coefficient to analyze the relationship between these variables. The Pearson correlation coefficient, a measure of the strength and direction of the linear relationship between two variables, has values between-1 and 1. The correlation coefficient is 1 if the two variables are completely related; 0 if the two variables are completely unrelated and-1 if the two variables have a negative correlation.

If the correlation coefficient between two variables is positive, it indicates a positive correlation between them, that is, an increase in one variable leads to an increase in the other variable. If the correlation coefficient between two variables is negative, it means that there is a negative correlation between them, that is, the increase of one variable leads to a decrease in the other variable. If the correlation coefficient between the two variables is close to zero, then it means that there is no linear relationship between them.

We conducted Pearson correlation analysis on the movement characteristics of three groups of excellent table tennis players to better understand the participation of various skeletal nodes of table tennis players in technical movements, and they can be improved and optimized. The calculation formula is as follows:

$$r_{XY}=\frac{COV(X,Y)}{\sigma_X\cdot\sigma_Y}=\frac{E(XY)-E(X)E(Y)}{\sqrt{E(X^2)-E^2(X)}\sqrt{E(Y^2)-E^2(Y)}}=\frac{\sum(X_i-\overline{X})(Y_i-\overline{Y})}{\sqrt{\sum(X-\overline{X})^2}\sqrt{\sum(Y-\overline{Y})^2}}$$

r_{xy} Is the Pearson correlation coefficient of X and Y variables, and COV (X, Y) is the covariance of X and Y variables; σ_x and σ_Y part is the standard deviation of X and Y;and E (X), E (Y) is the mathematical expectation of X and Y.

Observe the absolute value of the correlation coefficient, and the data can be similar by the following criteria

linear measure:
0.8 <r≤1.0 very strong correlation
0.6 <r≤ 0.8 strong correlation
0.4 <r≤0.6 moderate correlation
0.2 <r≤0.4 weak correlation
0<r≤0.2 absence of correlation

Acknowledgements

Fundamental Research Funds for Central Universities, Project Number: 2023MS095.

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