Research on the Application of Artificial Intelligence Technology in the Quality Evaluation of Experiential Physical Education

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Abstract. In order to improve the teaching quality of experiential physical education, a new method of teaching quality evaluation is designed, and the quantitative analysis of quality evaluation is realized by using artificial intelligence technology. First determine the teaching quality evaluation standard. In the process of physical education teaching, we use artificial intelligence technology to collect motion data, and realize the recognition and analysis of motion data from two aspects of image and voice. The evaluation system of experiential physical education quality is constructed and the evaluation index is set under the system. The specific value of the evaluation index and the corresponding weight value are calculated respectively, the quantitative result of the comprehensive evaluation index is compared with the evaluation standard, and finally the evaluation result of the quality of physical education is obtained. Through the test and analysis of the applied experiment, it is found that the application of artificial intelligence technology to the teaching quality evaluation method can effectively improve the authority of the evaluation results and indirectly improve the teaching quality of college physical education.

Keywords: Artificial intelligence technology · Experiential teaching · Physical education quality · Teaching quality evaluation

1 Introduction

Sports is a complex social and cultural phenomenon. It is a conscious, purposeful and organized social activity that promotes comprehensive development, improves life style, and improves physical quality and sports ability according to the laws of human body growth and development, skill formation and function improvement [1]. Physical education can be divided into mass sports, professional sports, school sports and other types, in which school sports is mainly through the teaching of teachers, so that students can master the relevant sports skills, and improve the physical quality of students. In order to improve the teaching quality of physical education in schools, the teaching methods of physical education curriculum have been changed gradually. Experiential education is a new form of training and education. It is based on the goal of moral education...
and the psychological and physiological characteristics of minors as well as their personal experiences. Let the juveniles experience and feel in real life, and form their own moral consciousness and ideological quality through reflection experience and experience internalization, and accumulate their own ideological and moral behavior through repeated experience. Minors dominate themselves and correct themselves in various experiences. They experience, feel and construct the patriotic feelings, national spirit and collective consciousness that the society and The Times expect them to have in their daily behaviors and interactions with others. Experiential physical education can be divided into four stages: personal experience, formation, test and reflection, which can encourage students to produce new experience and new understanding, and thus develop their ability to adapt to nature and society and form a positive attitude towards life. In order to achieve good teaching results of experiential physical education, teachers’ teaching quality should be evaluated regularly. The evaluation of physical education teaching quality is a very important part of the current reform of physical education teaching. Many experts and scholars have made fruitful research in this area, which has promoted the development of physical education evaluation theory and practice [2]. But at the same time, we should realize clearly that with the continuous deepening of the reform of physical education in colleges and universities, the current teaching quality evaluation system can not meet the needs of the current educational situation, and there are still many problems, which need to be further studied and improved. At present, the main technical methods used in the quality evaluation of experiential physical education include literature, questionnaire, analytic hierarchy process and so on. Due to the use of these techniques, the relevant factors of physical education evaluation are not clearly defined, the evaluation dimension is not comprehensive, and the evaluation index validity is low. Therefore, the evaluation results obtained by the traditional evaluation methods have no reference value.

In order to solve the above problems in traditional methods, artificial intelligence technology is introduced. Artificial intelligence is the study of the computer to simulate some of the thinking process and intelligent behavior of the subject, mainly including the computer to realize the principle of intelligence, the manufacture of computers similar to human brain intelligence, so that the computer can achieve a higher level of application. Artificial intelligence will involve computer science, psychology, philosophy and linguistics. Applying this artificial intelligence technology to the evaluation method of experiential physical education quality can realize the quantitative analysis of evaluation indexes and obtain more intuitive evaluation results. Through the analysis of the current physical education quality evaluation system, find out its existing problems, use artificial intelligence technology to solve the existing problems, in order to provide theoretical and practical reference for the future experiential physical education reform and physical education quality evaluation.
2 Design of Quality Evaluation Method for Experiential Physical Education Teaching

The evaluation of physical education itself is a complex system, which is composed of a large number of subsystems and elements. Physical education evaluation is a process, which is accompanied by the transmission of teaching information, evaluation information and feedback of evaluation information. Therefore, the evaluation of physical education is regarded as a system, and the problems in the evaluation of physical education are analyzed from the perspective of systematic scientific theory [3]. Therefore, in the actual process of experiential PE teaching quality evaluation, the system theory, information theory, cybernetics and the whole principle, order principle and feedback principle in the system science theory are the theoretical basis for the research and analysis of this article. Based on the above principles, artificial intelligence technology is introduced to optimize the design of experiential PE teaching evaluation method. The optimized teaching quality evaluation process is shown in Fig. 1.

According to the quality evaluation process shown in Fig. 1, the final teaching quality evaluation results are obtained by comprehensive consideration of teaching attitude, teaching ability and teaching effect.

2.1 Determine the Evaluation Criteria for Teaching Quality

The teaching attitude, ability and effect of experiential PE teachers are integrated, and the indicators reflecting teaching quality are quantified through the established teaching
quality evaluation index system. Finally, the evaluation results of teaching quality are converted into scores and divided into different teaching quality levels according to scores [4]. The evaluation standards for the quality of experiential physical education are shown in Table 1.

**Table 1.** Evaluation standards of physical education teaching quality

| Classification | Excellent | Good | Qualified | Unqualified |
|----------------|-----------|------|-----------|-------------|
| Score          | ≥85       | 76–84 | 60–75     | <60         |
| Under any one of the following circumstances, it cannot be rated as excellent | (1) Whether there is absenteeism; (2) being late or leaving early for three times or more in one semester; (3) general teaching accidents; (4) personal leave accumulated for more than one week and leave accumulated for more than two weeks |
| Any one of the following circumstances is incompetent | (1) The total score of the assessment is below 60 points; (2) the professional ethics is poor and can’t be a teacher, and there is serious teaching accident; (3) the accumulated absenteeism is 10 h or more in one semester; (4) the late arrival and early leave is 15 times or more in one semester; (5) the person who has been punished with more than demerit record in that year |

2.2 Curriculum Behavior Data Collection Based on Artificial Intelligence Technology

Data acquisition is an important part of data analysis. After obtaining the voice and image data related to teachers and students from the experiential PE class with data acquisition equipment, the data required for observation dimension and evaluation dimension are preprocessed based on the data required for observation dimension and evaluation dimension based on the analysis framework in combination with the analysis object and analysis index. Specific analysis dimensions were determined, and corresponding artificial intelligence technologies, including speech recognition and face detection, were selected for analysis to obtain statistical data such as frequency and time of behavior, speech, emotion and other aspects. Based on these statistical data, the visualization results of the whole classroom teaching behavior analysis were formed. Combined with data acquisition and pretreatment process [5]. Prepare the input device of artificial intelligence technology, namely sensor. As the course behavior data collected by using artificial intelligence technology includes students’ movement posture, movement time, energy consumption and other parts, it is different according to the type of artificial
intelligence interface. The relevant sensors are installed on the clothes of students and teachers in experiential PE teaching, and the sensors can collect the sports information of the research object in real time. The duration of course behavior acquisition by artificial intelligence technology is set to be 45 min, and the interval of behavior data acquisition is 1 min.

2.3 Data Matching and Analysis of Experiential PE Curriculum

Using the image recognition technology and voice recognition technology in artificial intelligence technology, based on the collected experiential physical education curriculum behavior data, the behavior and language of teachers and students in the teaching process can be identified by extracting and matching the data features.

2.3.1 Artificial Intelligence Sports Movement Image Recognition

Figure 2 shows the recognition process of sports movement images by artificial intelligence technology.

![Fig. 2. Schematic diagram of artificial intelligence image processing process](image)

According to the process shown in Fig. 2, the collected image information is firstly input into the processor of artificial intelligence technology, and the motion feature information in the image is extracted, and matched with the standard data feature in the artificial intelligence database [6]. If it is found that the similarity between the collected image features and a feature vector in the database is more than 75%, the actual motion behavior of the object can be determined. Taking throwing baseball as an example, the image recognition process and results obtained by using artificial intelligence technology are shown in Fig. 3.
2.3.2 Artificial Intelligence Speech Recognition

Natural language processing technology can not only be used to analyze teachers’ social circle colleagues or students’ evaluation of teachers so as to evaluate teachers’ teaching level, but also be used in various auxiliary teacher teaching applications. Figure 4 shows the processing process of real-time speech signals in artificial intelligence technology.

3 Construct the Artificial Intelligence Teaching Quality Evaluation System

Based on a series of theories, methods, techniques and means of systematic analysis, the factor analysis of the evaluation system of physical education is a systematic analysis of the elements of the evaluation system of physical education. The evaluation system of physical education is a multi-factor and multi-level complex system, which must adopt the most effective theory and method of systematic analysis in the system science to make a comprehensive, integrated and all-dimensional analysis and research, so as to understand its operation rules scientifically and profoundly [7]. According to the view of system theory, the system is an organic whole formed by the interrelation and interaction
of various elements. The multidimensionality and multilevel of the quality evaluation of experiential physical education determine the multifaceted and three-dimensional characteristics of its structure. Each of its latitudes contains many elements, and each element is often a system with a certain structure, these subsystems are connected and restricted with each other, carrying out nonlinear interaction. And through the exchange of information with the outside world to form and maintain an orderly structure of space and time. The quality evaluation of experiential physical education is not a single factor or a single aspect, but a complex system formed by the interrelation and interaction of the evaluation purpose, evaluation object, evaluation subject, evaluation index system, evaluation method, evaluation process and evaluation management. The evaluation content embodies the evaluation elements contained in the evaluation object. Firstly, the content is divided into teacher evaluation and student evaluation. Then, each dimension is divided into different levels according to the requirements of physical education evaluation. The evaluation content generally has multi-type and multi-level complex structure. Through the horizontal and vertical bidirectional decomposition of the evaluation content, a multi-level and multi-series content decomposition system equivalent to the integrity of the evaluation content is obtained. Then, according to the selection principle of evaluation index, the functional, characteristic and representative analysis of the content component is carried out to form the evaluation index system.

The evaluation subjects of teaching quality determined under the evaluation system mainly include the following five aspects:

(1) Evaluation of the preliminary planning and arrangement of teachers’ social physical education teaching courses. Including the effectiveness of teaching plan design, teachers’ manners, site selection and equipment supply, teaching resource content, curriculum planning and arrangement, the rationality of comprehensive training tasks and so on.

(2) Evaluation of the organization and methods of teachers’ social physical education curriculum [8]. Including educational methods or methods, curriculum and organization, teaching means, teaching adaptation, teaching control, differentiated processing ability and so on.

(3) Evaluation of teachers’ teaching and demonstration of social physical education courses. It includes the evaluation of teachers’ language standardization, demonstration effectiveness, communication between teachers and students, error correction ability, emotional attitude and physical and mental literacy level.

(4) Evaluation of the quality and effect of teachers’ social physical education courses. It includes the improvement of students’ knowledge and skills, satisfaction coefficient, lifelong view of physical education, and the improvement of students’ ability.

(5) Evaluation on the cultivation of students’ ideological concept in the course of social physical education. It includes the evaluation of ideological cultivation, political cultivation, moral cultivation and ideal cultivation.
### 3.1 To Set the Evaluation Index of Physical Education Teaching Quality

In the experiential PE teaching quality evaluation system, the research subjects of teaching quality evaluation are integrated, and corresponding evaluation indexes are set from three aspects of teaching attitude, ability and effect, as shown in Table 2.

| Criterion level       | Index level I                             | Secondary index level                      |
|-----------------------|-------------------------------------------|-------------------------------------------|
| Teaching attitude (A) | Preparation before class (A1)             | Prepare lessons carefully (A11)           |
|                       | Classroom performance (A2)                | Be punctual in class (A21)                |
|                       |                                           | Dignified manners (A22)                   |
|                       |                                           | Code of conduct (A23)                     |
|                       |                                           | Dedication and diligence (A24)            |
| Teaching ability (B)  | Professional theoretical level (B1)       | Level of professional knowledge (B11)     |
|                       |                                           | Professional skill level (B12)            |
|                       |                                           | Professional academic level (B13)         |
|                       | Organizational teaching level (B2)        | Moderate progress (B21)                   |
|                       |                                           | Reasonable design of teaching links (B22) |
|                       |                                           | Accurate interpretation of motor skills (B23) |
| Teaching effectiveness (C) | Organizational teaching level (C1)   | Students’ concentration (C11)            |
|                       | Improve students’ ability (C2)            | Improve students’ physique (C21)         |
|                       |                                           | Improve sports performance (C22)          |
|                       | Teaching effectiveness (C3)               |                                           |

Taking the evaluation index of teaching efficiency in the evaluation index of experiential physical education teaching quality as an example, this paper describes the specific calculation method of the evaluation index. The calculation formula of physical education teaching efficiency is as follows [9]:

\[
H_T = \ln \left[ 1 + \frac{C_s \sqrt{2 - C_T} (2 - C_s)}{(2 - C_T)^2} \right] 
\]

(1)

Where \( C_T \) and \( C_s \) represent the teaching quality of the teacher and the learning quality of the student respectively, which is the possible power of the effective output and input.
information in the process of teaching information. In order to maintain the consistency of the research, the grade value $C_S$ of the whole class students’ physical performance is less than 0, which is impossible in the practical examination.

### 3.2 Calculate the Weight of Evaluation Index System

In the teaching quality evaluation of physical education health course and elective project course, each evaluation item of physical education occupies a different position. Therefore, it is necessary to assign different weights to each sports evaluation item and the specific evaluation index reflecting the item in each item [10, 11]. In general, the weight should meet two conditions: weight $\xi_i$ should be evaluated between 0 and 1, and the weight sum of each index should meet the conditions expressed in formula 2.

$$\sum_{i=1}^{n} \xi_i = 1 \quad (2)$$

This paper presents a method of multi-factor classification to solve the complex system problem, which can be used to determine the weight of physical education quality index scientifically. First, the important procedure of comparing the indicators, the judgment matrix $A$. When judging the relative importance of indicators, please refer to Table 3.

#### Table 3. Weight table of quality evaluation of experiential physical education

| Relative importance assignment | Meaning                        | Explain                                         |
|-------------------------------|--------------------------------|------------------------------------------------|
| 1                             | Equally important              | Both contribute the same to the goal            |
| 3                             | Slightly important             | One is slightly better than the other           |
| 5                             | Important                      | One is better than the other                    |
| 7                             | Much more important            | One is more favorable than the other and has been confirmed |
| 9                             | Extremely important            | The former is more important than the latter    |

According to the comparison of the importance of the two indicators, an n-order matrix is obtained as the judgment matrix [12]:

$$A = \begin{pmatrix}
1 & a_{12} & \cdots & a_{1n} \\
a_{21} & a_{22} & \cdots & a_{2n} \\
\vdots & \vdots & \ddots & \vdots \\
a_{n1} & a_{n2} & \cdots & 1
\end{pmatrix} \quad (3)$$

Because of the complexity of objective things and the diversity of human judgment, it is obviously difficult to achieve the complete consistency of every judgment matrix. At
this time, the following method can be used to determine whether it is acceptable or not. The main idea is to set $\lambda_{\text{max}}$ as the maximum characteristic root of matrix $A$, which can be concluded that if and only if $\lambda_{\text{max}}$ is equal to $n$, $A$ has complete consistency. In general, there is:

$$\lambda_{\text{max}} \geq n \quad (4)$$

Then the consistency index is introduced [13]:

$$C.I = \frac{\lambda_{\text{max}} - n}{n - 1} \quad (5)$$

If $C.R$ is greater than 0.1, re-evaluate to construct $A$; if $C.R$ is less than or equal to 0.1, solve the equation with respect to $W$ and take the discriminant matrix of different orders with random composition as the sample, calculate the average consistency index $R.I$ and find the consistency rate:

$$C.R = \frac{C.I}{R.I}$$

If the solution vector $\xi_i$ is normalized, the weight set can be obtained.

According to the sports data collected by artificial intelligence technology, the specific value of each evaluation index and the weight value of evaluation index are calculated respectively [14, 15]. The results of the evaluation index of comprehensive experiential physical education quality are obtained. Compared with the established evaluation standard, the quantitative evaluation result of experiential PE teaching quality is obtained, and the visualization of educational and teaching quality evaluation is realized.

4 Application Performance Test Analysis

This application experiment is to verify the application of artificial intelligence technology in the quality evaluation of experiential physical education. 18 classes of grade 7 in a city no. 1 middle school were selected as the practice objects and divided into experimental classes and reference classes, in which 1–9 classes were the experimental classes and 10–18 classes were the reference classes. In the teaching practice, according to the evaluation indexes of the evaluation system, the teaching content is adjusted, the teaching process is adjusted, the teaching details are paid attention to, and the students are guided to make a three-dimensional and comprehensive evaluation from different points and aspects. Among them, teachers’ comments and parents’ participation are also intermingled to make comprehensive evaluation. Finally, the optimization of physical education quality evaluation system in secondary vocational schools is realized through continuous adjustment, so as to promote the improvement of physical education quality in schools. After the teaching quality evaluation, the quality evaluation results of
the experimental class and the reference class were obtained, as well as the statistical results of the students’ physical performance under the application of the two evaluation methods, as shown in Table 4.

**Table 4.** Comparison results of applied experiments

| Test items  | Reference group | Experience group |
|-------------|-----------------|------------------|
|             | Assessment      | Assessment        |
|             | results         | results           |
| Long-distance run | Qualified     | 83               | Excellent | 92   |
| Sprint      | Excellent       | 86               | Excellent | 95   |
| Basketball  | Good            | 87               | Excellent | 93   |
| Rope skipping | Unqualified | 84               | Good      | 94   |
| Volleyball  | Excellent       | 91               | Excellent | 96   |

From the statistical results in the table, it can be seen that the evaluation results of experiential physical education quality obtained before and after the application of artificial intelligence technology are quite different. The application of artificial intelligence technology can timely adjust the content and form of experiential physical education, so the evaluation result of teaching quality is higher. From the point of view of students’ physical performance, through the application of artificial intelligence technology, students’ physical performance has been improved in many aspects, and the comprehensive performance has been improved by about 7.8 points, which can prove the application value of artificial intelligence technology in the quality evaluation of experiential physical education.

5 Conclusion

The evaluation of physical education quality needs a comprehensive, scientific, reasonable and effective evaluation standard system. Moreover, the effect of different students’ learning varies according to the content of learning and the need of development. Therefore, it is necessary and urgent to establish a hierarchical evaluation standard system with consistent dimensions and different contents. The application of artificial intelligence technology can realize the visual evaluation of physical education quality.

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