Research Article

Evaluation of Multimedia Physical Education Teaching Quality considering Data Analysis Model

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The 21st century is in the era of information explosion, the level of information technology is also increasing day by day, and the fields of its application are also wider and wider. As a new classroom teaching method that relies on information technology, multimedia teaching has become an important knowledge transfer method in colleges and universities. As a practical major, physical education (PE) often uses multimedia teaching in teaching. However, in many schools, the advantages of multimedia PE have not been fully exerted, which also makes the quality of multimedia PE not high. For the purpose of providing solutions to the problems existing in the current multimedia PE teaching, based on the characteristics and requirements of multimedia PE classroom teaching, this paper selected teachers and students from a college of PE to conduct interviews and questionnaires. Through the theoretical analysis of quality evaluation and the introduction of research methods, the evaluation indicators and weights of multimedia physical education teaching quality were determined, and the quality evaluation model of multimedia PE teaching in this university was established, and the practical application analysis was carried out. After determining the quality evaluation indicators and weights of multimedia PE, the actual application analysis included the evaluation of teachers with different titles and genders, as well as the evaluation of teachers by students of different grades. According to the assessment results, students’ evaluation of teaching quality was not obvious in terms of teachers’ gender, but there were differences in professional titles. Among them, associate professors had the highest evaluation score of 82.14, and students of different grades had different evaluations of teachers. The empirical analysis proves that the evaluation index and data analysis model of this paper have research significance.

1. Introduction

Teaching quality is the cornerstone of school development, and PE is also a very important subject in the teaching work of schools, and its teaching quality cannot be ignored. The purpose of PE in schools is not only to enable students to acquire expertise and skills of sports but also to actively develop their physical and mental qualities and develop good habits of physical exercise. At the same time, college education is the last stop of campus education, and good physical condition is an important guarantee to support individuals to realize their ideals. Active PE can better provide students with a healthy body when they enter the workplace in the future. The society is progressing and technology is developing, which also accelerates the updating of educational knowledge, and the teaching mode and means are gradually developing towards modernization. In the 21st century, with the diverse scientific and technical levels’ quick development, in this context, the multimedia classroom teaching mode combines information technology and modern educational theory. Because it can fully reflect the characteristics of students’ subjectivity, more colorful teaching content, and more vivid teaching forms in teaching, it has been widely used in major universities, and PE is no exception. In the process of educational practice, teaching quality assessment can be used as a “bridge” between theory and practice, helping educational teaching behavior to be better combined with educational theory, so as to better apply the objective laws of educational development and achieve better teaching effects. Therefore, it is necessary to
study the quality evaluation of multimedia physical education.

As an important indicator to measure PE teaching, teaching quality has been studied by many scholars. Liu believed that the number of PE professionals in schools was not dominant, and a large part of the reason for this phenomenon was the imperfect assessment system of PE teaching quality [1]. Sun and Zhou combined the PE work of schools with the development of society. The importance of PE teaching was put forward, and a system for assessing the quality of PE was created by using variety of evaluation techniques [2]. Zhao and Qin believed that the quality evaluation of PE was related to the students’ learning effect of the subject and the improvement of physical quality. Also, by analyzing the requirements of social development and the status quo of the evaluation system, the corresponding suggestions for the assessment of sports quality in colleges were given [3]. Peng analyzed the quality assessment management of PE teaching through neural network and believed that the quality assessment of PE teaching should not only focus on the improvement of students’ physical function and quality but also need to tap and develop students’ development potential [4]. Liu et al. designed a PE quality assessment system. Through theoretical research, the design of the system was proposed [5]. Sun believed that the quality of PE had a great influence on students’ physical and emotional health. Therefore, the quality of classroom teaching could be evaluated by means of performance evaluation [6]. Most of these studies on teaching quality are based on the characteristics of teaching quality evaluation itself, and most of them are theoretical analysis, and few use data for analysis. However, theory needs to be combined with practice after all. By using the data analysis model, the variables that affect the quality of physical education can be better obtained, so as to better achieve the goal of physical education.

As a mathematics-based evaluation model, fuzzy comprehensive evaluation method is involved in many types of evaluation research. Li et al. used fuzzy comprehensive evaluation to conduct a comprehensive evaluation of project performance management in the engineering industry. The results showed that the method had certain applicability [7]. Loh et al. applied this method to the impact of port supply chain disruption on port operation management. It mainly discussed its possibility and consequences through fuzzy comprehensive evaluation [8]. Yang and Mak scored the sound environment of the classroom based on fuzzy comprehensive evaluation, aiming to optimize the classroom environment for teaching [9]. Lin et al. applied this evaluation method to the development and operation of homestays. Through the establishment of an evaluation system, the indicators that affected the sustainable development of homestays were evaluated and analyzed [10]. Cui et al. used fuzzy comprehensive evaluation to analyze the factors affecting blast furnace smelting in the chemical manufacturing industry [11]. It can be seen that the fuzzy comprehensive evaluation method is widely used in assessment research, and the effect is good. Teaching quality evaluation is also a kind of evaluation. It is feasible to use fuzzy comprehensive evaluation to study teaching quality evaluation.

High-quality higher education is the expectation of society for higher education. The fundamental responsibility of the university, as a form of high level education, is to do a good job of teaching and learning. An important evaluation direction for assessing the completion of education and teaching is the quality of teaching. School education is the last stop for students to complete their education, and the caliber of its instruction affects not only the future growth of individuals but also the advancement of educational institutions. Therefore, to support the transformation of higher education, teaching must be made of higher caliber. In this context, a strategy for evaluating teaching quality that is scientific and reasonable must be developed in accordance with the teaching features and instructional goals of college courses. Starting from the importance of PE teaching in colleges and universities, this paper establishes the teaching quality evaluation index according to the characteristics of multimedia teaching and PE teaching. The AHP approach is used to determine each index’s weight, and then the index is subjected to matrix operation using the fuzzy comprehensive evaluation method. Therefore, a data analysis model of multimedia PE teaching quality evaluation is constructed, which is used for analysis through visiting and survey. Also, the results of students’ evaluation of teaching quality are obtained. The results prove that the programming of teaching quality evaluation meets the reality.

2. Assessment Index and Model of Multimedia PE Teaching Quality

2.1. Assessment Index Design. Teaching quality evaluation is to evaluate teachers’ academic level, teaching methods, and attitudes, and the main purpose is to improve teaching quality. The assessment of multimedia teaching quality is unlike the traditional teaching quality evaluation. It is necessary to construct a new teaching quality assessment system according to the characteristics of multimedia teaching and PE courses [12], such as the selection and use of multimedia media, the design and teaching of multimedia courseware, and so on. According to the modern education teaching theory and modern education evaluation theory, the principles of constructing evaluation indicators are shown in Figure 1.

From Figure 1, the design of teaching quality evaluation indicators needs to follow a number of principles. The main reason is that the purpose of evaluating teaching quality is not to prove anything but to improve teaching and play a better role in teaching [13]. The development of any thing has certain laws. For modern society, scientificity is an important principle to be followed in the process of development and innovation of things. The scientific nature requires that the evaluation indicators of teaching quality need to take into account the theory, practice, and application methods. On the premise of following the scientific nature, the evaluation of teaching quality also needs to consider the combination with practice, that is, the principle of operability is required. At the same time, the evaluation of
teaching quality involves many aspects, which is a complex and huge process. In this process, the indicators should be clearly demarcated and systematic, so as to ensure the optimal function of the entire assessment indicator system [14]. Finally, for evaluation, there are two aspects: subjective and objective. For the assessment of teaching quality, it is necessary to combine these two aspects to design.

In addition to the design principles, quality assessment should also pay attention to some requirements, as shown in Figure 2.

From Figure 2, in the design of teaching quality assessment indicators, first of all, the consistency of the level indicators must be taken into consideration. Secondly, these indicators also need to meet the requirements of measurability, comparability, feasibility, independence, completeness, and acceptability [15, 16].

The teaching quality evaluation is multidimensional, and it is a process in which multiple factors interact and influence each other. Based on this, the production and design of courseware, the subject’s classroom instruction, and the subject’s overall educational impact all are taken into consideration when evaluating the effectiveness of multimedia physical education teaching.

The first is the evaluation of multimedia courseware. Courseware is an important tool for teaching, which can reflect the meaning and logic of teaching. Also, the multimedia courseware should realize the diversification and three-dimensionalization of the teaching process according to the interactivity of the multimedia computer [17]. The evaluation of multimedia courseware mainly includes the following:

Teaching. Whether the teaching objectives are clear. Whether the expression of knowledge points is scientific and normative. Whether the content is focused, simple to comprehend, and simple to accept. Whether the presentation is novel and attractive. Whether talent and original thought are prioritized to develop. Whether the media information such as sound and animation can be used reasonably.

Technical. Whether the software works reliably. Whether it is convenient to maintain and manage. Whether the operation is simple. Whether it has good interactivity and navigation. Whether the storage is safe. Whether the compatibility of software operation is strong.

Artistic. Whether the overall layout and style are in harmony. Whether the layout is simple and beautiful. Whether the effect is real. Whether the sound quality of the multimedia soundtrack is clear. Whether the font and font size are reasonable. Whether the color perception is comfortable.

The second is the assessment of the teaching process. The teaching process is the process by which students understand learning. Therefore, the assessment of teaching quality not only needs to focus on the assessment of the explanation of knowledge points but also needs to focus on the evaluation of creative ability and comprehensive application ability learning [18]. The evaluation of the multimedia teaching process mainly includes the following:

Teaching Detail. Whether the detail is consistent with the teaching objectives. Whether theories, viewpoints, and concepts are clear and focused.

Teaching Attitude. Whether the attitude of preparing lessons and answering questions in the classroom meets the needs. Whether the lesson plan is clear and organized. Whether the teaching plan is scientific. Whether the form of homework can cultivate students’ ability to solve problems and learn independently.
Teaching Ability and Organization. Whether the teaching process is logical and clear. Whether the academic level is sufficient. Whether there are any variety of teaching methods. Whether the subjectivity of students is respected. Whether the subjectivity of students is respected. Whether there is the ability to adjust the classroom atmosphere.

Instructional Media. Whether the use of media is reasonable. Whether the operation is efficient.

The last is the evaluation of teaching effect. Teaching effect is an important indicator to test students’ knowledge mastery. The educative impact is mainly reflected in the teaching effect of the classroom and the educative impact of the course. Therefore, the evaluation of teaching effect will also be carried out from these two aspects:

Classroom Teaching Effect. Whether the student’s class attendance is high. Whether students have strong interest in the classroom. Whether there is a lot of communication in the classroom between students and teachers as well as between students. Whether the correct rate of classroom questions or homework checks is high.

Curriculum Teaching Effect. Whether the mastery of basic knowledge meets the requirements. Whether the cognitive level has been improved. Whether the ability to solve problems has been enhanced.

After determining the basic content of multimedia teaching quality assessment, index items are established for the content of these evaluations. These index items mainly include overall goals and signs at the first and second levels [19]. According to the content of the previous analysis, the analysis of the quality evaluation of multimedia physical education is carried out from the three overall goals of courseware, classroom teaching process, and teaching effect.

2.2. Data Analysis Model Design. An essential component of the study of the evaluation of teaching quality is the calculation of the assessment index weight. Weight refers to the importance of each indicator in the whole. The weights of different indicators are different, which indicates that the evaluators focus on the assessment of teaching quality [20]. The principle of AHP is to decompose elements into multiple levels and then perform qualitative and quantitative analysis according to the levels. It is a commonly used weight setting method. This article uses the AHP to construct the indicator weights. The obtained data analysis model of multimedia teaching quality evaluation is shown in Figure 3.

As shown in Figure 3, the constructed multimedia PE quality evaluation data analysis model is mainly carried out through the analytic hierarchy process and the fuzzy comprehensive evaluation method. Fuzzy comprehensive evaluation is an evaluation method for the overall evaluation of objects restricted by many factors. It has a good analysis effect on such non-deterministic and difficult-to-quantify problems.

First, the indicators of the same group in the indicators are compared pairwise, the construction of the matrix is judged, the maximum eigenvalue in the matrix and its corresponding eigenvector are obtained, and the resulting vector is the weight set by normalization. In the same way, the weight of each group of indicators is calculated, and then the consistency test of the judgment matrix of each group of indicators is carried out [21]. The calculation formula for the test is

\[ C = \frac{C_{Im}}{R_{Im}} \]

where \( m \) represents the order of the judgment matrix and \( R_{Im} \) represents the average random consistency index.

After the weights of the indicators are determined, the fuzzy comprehensive evaluation method is used to construct the model. First, it is assumed that the index set of the main factor is \( V = (V_1, V_2, \ldots, V_n) \), the index set of the sub-factor layer is \( V_Z = (V_{Z1}, V_{Z2}, \ldots, V_{Zm}) \), and the comment set is excellent, good, medium, and poor [22, 23]. Then, the fuzzy evaluation matrix of a factor is

\[ R_Z = \begin{bmatrix} r_{11} & r_{12} & \cdots & r_{1n} \\ r_{21} & r_{22} & \cdots & r_{2n} \\ r_{31} & r_{32} & \cdots & r_{3n} \\ r_{41} & r_{42} & \cdots & r_{4n} \end{bmatrix} \]

According to the matrix, the fuzzy comprehensive evaluation matrix is calculated as

\[ H = D \times R_Z \]

where \( D \) represents the weight set obtained by the AHP and \( \mu \) represents the index weight obtained by the AHP.

3. Objects and Methods and Evaluation Indicators

In this paper, students from a certain university were selected to participate in the quality evaluation of multimedia PE. According to the obtained results, the data analysis model was carried out according to the obtained survey data, and the final result was obtained. According to the scientific principle of evaluation, the comprehensive results of this teaching quality evaluation were obtained according to four methods: student assessment, expert assessment, peer assessment, and teacher self-evaluation [24]. The result weight of student evaluation was 0.5, the weight of expert evaluation was 0.3, and the weight of peer evaluation and teacher self-evaluation was 0.1 each. Scores of 90 and above were considered excellent, between 75 and 90 were good, between
and 75 were moderate, and below 65 were poor. Then, the calculation formula of the comprehensive evaluation result is

\[ \phi = \lambda_1 \cdot 0.5 + \lambda_2 \cdot 0.3 + \lambda_3 \cdot 0.1 + \lambda_4 \cdot 0.1. \]  

(4)

This paper set up an evaluation scale according to the evaluation indicators and conducted a questionnaire survey at the end of the first semester. A total of 8 teachers were evaluated. The students participating in the evaluation were students from 5 classes of different majors in the School of PE, with a total number of 200 students. A total of 200 student evaluation questionnaires were distributed and 200 were returned. Expert evaluation was to select 5 school experts, and each expert randomly listened to each teacher more than 3 times. Peer evaluation was conducted by teachers of intramural PE courses, and it was also randomly attended three or more times during the semester. Teacher self-assessment was conducted by the teacher himself after the end of the semester.

According to the previous analysis, this paper determines the quality assessment indicators and weights of multimedia PE teaching, as shown in Table 1.

### 4. Results

The analysis of the results of this paper is carried out according to the three evaluation indicators of student evaluation elements A, B, and C, and the analysis is carried out according to different evaluation directions.

#### 4.1. Evaluation Results of Different Teacher Titles

Through data sorting, the scores of different evaluation elements are calculated for teachers with different teacher titles, and the obtained results are shown in Figure 4.

As shown in Figure 4, the score results of the three elements of teachers with different professional titles are inconsistent, and the scores of other items with high scores in one item may have lower scores. Judging from the evaluation results of multimedia courseware, the younger the teacher is, the higher the evaluation score is, which is also in line with reality. The aesthetic style of young teachers is generally closer to that of students. In the evaluation of teaching process and teaching effect, the score of associate professors is significantly higher, which is also in line with the growth law of teachers. According to the scores of the three elements, the comprehensive scores of students’ evaluation of teachers with different professional titles, and the results of adding peer evaluation, expert evaluation and self-evaluation are shown in Figure 5.

As shown in Figure 5, associate professors scored the highest in student evaluation, followed by lecturers. This is in line with the law of professional development of university teachers.

#### 4.2. Evaluation Results of Teachers of Different Genders

In order to test whether there are differences in the teaching quality evaluation of teachers of different genders, this paper conducted quality evaluation score statistics according to the gender of teachers, and the obtained results are shown in Figure 6.

As shown in Figure 6, the evaluation results of the three elements of teachers of different genders are different. From the data in the figure, in terms of different factors, the scores of male and female teachers are different, but the difference is not big. It shows that in the teaching of 81.04 multimedia classes, male and female teachers have their own advantages, but they are not obvious. The scores are then weighted, and the students’ comprehensive evaluation scores and total scores are obtained as shown in Figure 7.

As shown in Figure 7, for teachers of different genders, the comprehensive scores of students’ evaluations show that the score of male teachers was 81.18, and the score of female teachers was 81.04. It can be seen that there is little difference between the two. It shows that there is no obvious difference between teachers’ gender in students’ evaluation of teachers’ multimedia PE courses. The overall rating for male teachers was 82.37 and the overall rating for female teachers was 82.39. The small difference in scores indicates that male and female teachers have almost no distinction in the quality of multimedia PE teaching, that is, the effect of teaching is almost irrelevant to the gender of the teacher.

#### 4.3. Evaluation Results of Students of Different Grades

According to the evaluation results of students of different grades on the quality of multimedia PE, the three elements of the scores of students in different grades on teachers are shown in Table 2.
As shown in Table 2, students in different grades rated each teacher differently, but generally, freshmen gave higher ratings. In order to better see the differences in teachers’ teaching quality scores of students of different ages, this paper draws the comprehensive evaluation scores of students of different grades into a chart, as shown in Figure 8.

As shown in Figure 8, the evaluation results of students of different grades are different. As can be seen from the figure, the first-year students generally have higher evaluation scores, while in contrast, the third-year students have the lowest comprehensive score. It shows that for students of different grades, there are differences in the evaluation of the quality of multimedia PE classroom teaching, which is
mainly related to the psychology of students of different grades. Shortly after entering the university, the junior students still maintain a fresh sense of the college classroom, while the senior students gradually get used to the college classroom. Therefore, there are certain differences in the evaluation psychology of students of different grades.

Through the analysis of the evaluation results, it can be seen that the evaluation results of multimedia sports classroom quality are related to many factors. From the perspective of students, the gender of teachers hardly affects the evaluation of teaching quality. However, teachers with different professional titles have different sense of classroom experience, and young teachers need to learn more teaching experience from excellent teachers. Similarly, older teachers can also join the atmosphere of young people and design multimedia courseware that is closer to students. Students of
different grades also have different requirements for the classroom. When teaching multimedia PE, teachers should also make teaching plans for students of different grades, so as to achieve better teaching effect [25].

5. Conclusion

Through the research of this paper, for students, the evaluation results of teachers’ teaching quality have nothing to do with the gender of teachers. However, in the process of using multimedia for PE teaching, teachers with different professional titles have differences in both courseware design and PE teaching process. Relatively speaking, young teachers are more suitable for the style of students in the design of courseware. In the course of the classroom and in the evaluation of the effect of classroom learning, teachers with slightly higher professional titles are better able to grasp the realization of the teaching effect of the course, which is more suitable for students’ learning interests. When students are in different grades, their preferences for teaching quality evaluation are also different, and the evaluation scores of freshmen are significantly higher than those of old students. It shows that for multimedia PE, teachers themselves need to study the development of the teaching process, improve the ability to control the classroom process, and improve the teaching effect. For students in high and low grades, it is necessary to design a teaching plan based on their attitude towards learning and adaptability to the environment. The quality evaluation of multimedia PE can analyze the implementation effect of using multimedia technology in PE, so as to provide a better direction for PE teaching mode and promote the development of PE. Due to the limitation of conditions, the data analysis model proposed in this paper is not perfect, and there is no large-scale empirical research on the indicators. This is where future research needs to be improved. All in all, the evaluation of multimedia physical education teaching quality has a certain practical significance for the promotion of multimedia physical education.

### Table 2: Scores on the three elements of teachers by students in different grades.

| Teacher  | A   | B   | C   | A   | B   | C   | A   | B   | C   |
|----------|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Teacher1 | 81.03 | 80.14 | 79.56 | 80.01 | 78.36 | 78.54 | 76.96 | 75.32 | 75.36 |
| Teacher2 | 80.27 | 81.02 | 80.35 | 79.12 | 78.33 | 77.25 | 78.41 | 77.92 | 75.26 |
| Teacher3 | 79.63 | 80.26 | 79.02 | 75.32 | 76.37 | 77.21 | 74.29 | 75.37 | 76.51 |
| Teacher4 | 80.12 | 80.23 | 80.12 | 78.56 | 76.33 | 75.36 | 76.98 | 74.21 | 72.17 |
| Teacher5 | 79.36 | 82.57 | 80.31 | 80.13 | 79.35 | 76.63 | 77.82 | 75.21 | 72.36 |
| Teacher6 | 80.17 | 83.69 | 82.14 | 79.26 | 76.32 | 75.47 | 76.96 | 75.36 | 73.14 |
| Teacher7 | 81.26 | 79.36 | 80.52 | 81.25 | 79.98 | 73.52 | 75.62 | 73.27 | 72.36 |
| Teacher8 | 83.33 | 82.27 | 79.21 | 82.11 | 80.25 | 78.29 | 78.32 | 76.32 | 74.98 |

### Figure 8: Evaluation results of students in different grades.

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teaching effect. Continued research on teaching quality evaluation is more conducive to the realization of the overall goal of teaching.

Data Availability

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

Conflicts of Interest

The author declares that there are no conflicts of interest.

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