

From Construction to Promotion: Research on Evaluation Index System of Professional Skills of Higher Vocational Physical Education Teachers

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Abstract: Currently, China's high-level higher vocational colleges are undergoing a critical period of development. The professional skills of higher vocational physical education teachers directly influence the quality of talent training. As the core of physical education, "teachers," "teaching materials," and "teaching methods" possess characteristics such as specificity, relevance, and flexibility. This study aims to effectively enhance the professional skills of higher vocational physical education teachers. Through the analytic hierarchy process (AHP), this study establishes a reasonable and effective evaluation system of physical education teachers' professional skills in higher vocational education, accurately positioning the weak links of higher vocational physical education teachers' professional skills, and providing guidance for targeted and directed improvement of higher vocational physical education teachers' professional skills.

1. Research Purpose

The National Vocational Education Reform Implementation Plan ("Vocational Education 20") points out that "vocational education and general education are two different types of education and have equal importance." [1] In today's "three education" reform, physical education teachers are the main body of the "three education" reform and the key to the "three education" reform. The compilation of teaching materials and the implementation of innovative teaching concepts rely heavily on physical education teachers. Against the backdrop of the "Three Education Reforms," higher vocational physical education teachers face new requirements and challenges. The level of professional skills of PE teachers directly affects the quality of teachers. What influence factors determine the professional skill level of PE teachers in higher vocational colleges? How to make professional skill evaluation index for PE teachers in higher vocational colleges? How to improve the professional skills of PE teachers in higher vocational colleges? The construction of the evaluation index system of professional skills of physical education teachers in higher vocational colleges will provide quantifiable development indicators for the improvement of professional skills of physical education teachers in higher vocational colleges. From the fundamental principle of student-centered learning, this study aims to explore teaching methods and approaches better suited to students, providing theoretical references and evaluation criteria for the "Three Education" reform in the construction and teaching reform of higher vocational physical education teachers' teams[2].

2. Research Objects and Research methods

2.1 Research Objects

Some high level and high level professional group construction higher vocational colleges: Wuhan Polytechnic, Huanggang Polytechnic College, Wuhan Railway Vocational College Of Technology, Wuhan Electric Power Technical College, Shenzhen Polytechnic University, Jinhua Polytechnic, Zhejiang Industry & Trade Vocational College, Changsha Social Work College,

Nanjing Vocational College of Information Technology, Zhejiang Financial College, Wuhan Institute of Shipbuilding Technology, Beijing Polytechnic College, Sichuan Engineering Technical College, higher vocational physical education teachers, department leaders and personnel department leaders, but also increased the object of teaching (that is, physical education students).

2.2 Research methods

Questionnaire survey method: The survey targeted 34 PE teachers, 12 PE department leaders, 17 school personnel department leaders, and 187 PE professional students from higher vocational colleges. Surveys of PE professional and vocational students were conducted through centralized testing and onsite collection. For other subjects, surveys were distributed via centralized testing and email, resulting in 160 questionnaires distributed, with 158 valid responses, achieving a recovery rate of 98.7%.

Interview method: In the process of determining the professional quality indicators of higher vocational physical education teachers, 15 experts including sports sociology, higher education, sports training and physical education teachers were selected as the interview subjects[3].

Analytical method: AHP analytic hierarchy process: This paper refers to a systematic method proposed by American operations research scientist Thomas LoSatty to deal with the problem of responsibility through layer by layer decomposition and comparison. In this paper, according to the basic procedure of analytic hierarchy process, the multilevel index system of professional skill evaluation of PE teachers in higher vocational colleges is constructed, and the weight of each index is determined.

3. Results and analysis

3.1 Determination of evaluation indicators of professional skills

In order to comprehensively improve the quality of physical education teachers in higher vocational colleges, we first evaluate the current quality level of physical education teachers in higher vocational colleges by establishing a quality evaluation system for physical education teachers in higher vocational colleges, find out the gaps, and then carry out purposeful, targeted and directional improvement of professional quality of physical education teachers in higher vocational colleges. This paper draws on the previous experience of scholars in the research on the improvement of professional quality of higher vocational physical education teachers, changes the slogan of advocating the improvement of professional quality of physical education teachers, and uses mathematical statistics to improve the professional skills of higher vocational physical education teachers. The model of the professional quality evaluation system of PE teachers in higher vocational colleges is established through the participation of teachers themselves, the leaders of their departments and the leaders of personnel management departments.

This study focuses on two main aspects to establish the professional skills index system for higher vocational physical education teachers. First, through the expert interview, a preliminary understanding of the professional skills that excellent physical education teachers in higher vocational colleges should have; Secondly, by referring to the factors of the quality of PE teachers in higher vocational colleges in similar studies. Therefore, on the basis of collection, analysis, induction and integration, 45 indicators of PE teachers' professional skills are formulated.

Based on the survey of 160 participants and the frequency analysis of initial professional skills indicators, a selection ratio was applied, leading to the final determination of 25 professional quality indicators for higher vocational physical education teachers. Research results show that the top 25 competency characteristics are distributed in the order of the frequency selected by the subjects, as shown in Table 1.

Table 1. Occurrence frequency of professional skill index of PE teachers in higher vocational colleges

| Quality index of PE teachers in higher vocational colleges | Sort | Select proportion | Number of selections |
|--|------|-------------------|----------------------|
| Pay attention to individual differences of students and teach students in accordance with their aptitude | 1 | 98.73% | 156 |
| PE teachers' level of athletes, academic qualifications and scientific research ability | 2 | 96.20% | 152 |
| Love the PE teacher career | 2 | 96.20% | 152 |
| Full preparation of teaching, rich content, novel teaching materials | 4 | 95.15% | 150 |
| Have safety prevention of accident and emergency handling capacity | 5 | 93.67% | 148 |
| Have the ability to lead | 6 | 91.72% | 145 |
| Have the ability to judge | 7 | 86.70% | 137 |
| Determine teaching goals before physical education course | 8 | 85.44% | 135 |
| Prepare teaching equipment and understand the characteristics of teaching equipment | 9 | 76.58% | 121 |
| Knowledge of relevant courses and related knowledge | 10 | 74.05% | 117 |
| Classes on time and no dragging and no leaving early | 11 | 70.89% | 112 |
| Do not transfer classes without reason, do not leave at random | 12 | 65.82% | 104 |
| Teacher's noble morality plays an exemplary role in front of students | 13 | 62.02% | 98 |
| Compliance with educational laws and regulations | 14 | 59.49% | 94 |
| Stimulate students' interest and motivation | 15 | 55.06% | 87 |
| Good at sports demonstration | 16 | 52.53% | 83 |
| Help students develop good sports habits | 17 | 51.27% | 81 |
| Ability to organize sports competitions | 18 | 49.36% | 78 |
| Have physical appearance and physical fitness of PE teacher | 19 | 46.84% | 74 |
| Understanding of Sports Venue Planning | 20 | 44.93% | 71 |
| Ability to coordinate communication with counselors and administrators | 21 | 43.67% | 69 |
| Be able to manage relationships with peers | 22 | 43.67% | 69 |
| Support the teaching spirit of the school | 23 | 41.72% | 66 |
| Using various kinds of teaching media to improve the effect on teaching; | 24 | 40.03% | 63 |
| Prepare the activities of the parts of the course according to the objectives | 25 | 40.03% | 63 |

3.2 Establishment of professional skill evaluation system model

After the establishment of 25 evaluation indicators of professional skills of higher vocational physical education teachers, according to the frequency analysis of the check list, the 25 indicators of professional skills of higher vocational physical education teachers included in Table 1 are divided into 5 types of professional skills indicator groups according to the belonging scope of professional skills of higher vocational physical education teachers: pre-class preparation and course plan, teaching attitude, teacher physical education professional ability, Teachers' guidance and communication ability, teaching methods. These professional skill indicator groups of higher vocational physical education teachers and the specific sub-indicators contained in them together

constitute a complete evaluation model of professional skill indicators of higher vocational physical education teachers, as shown in Table 2.

Table 2. The system of evaluation of PE teachers in higher vocational colleges

| First level element | Second level element | Third level element | Weight | Sort | S_1^2 | W | |
|--|---|--|---|--------|---------|-------|-------|
| Vocational skills of PE teachers in higher vocational colleges | Pre-class Preparation and Teaching Plan | Determine teaching goals before physical education course | 0.0291 | 3 | 0.01 | 0.731 | |
| | | Preparation of teaching equipment and understanding of equipment characteristics | 0.0386 | 2 | 0.02 | | |
| | | Prepare the activities according to the teaching objectives | 0.0280 | 5 | 0.04 | | |
| | | Understanding of course content and related knowledge | 0.0291 | 4 | 0.02 | | |
| | | Full preparation, rich content and novel teaching materials | 0.0418 | 1 | 0.04 | | |
| | Teaching attitude | | Compliance with educational laws and regulations | 0.0335 | 3 | 0.06 | 0.613 |
| | | | Compliance with educational laws and regulations | 0.0274 | 4 | 0.04 | |
| | | | Do not transfer classes without reason, do not leave at random | 0.0335 | 3 | 0.03 | |
| | | | Love the PE teacher career | 0.0586 | 1 | 0.01 | |
| | | | Teacher's noble morality plays an exemplary role in front of students | 0.0349 | 2 | 0.01 | |
| Teachers Professional Ability of Physical Education | | level of athletes, academic qualifications and scientific research ability | 0.0579 | 1 | 0.04 | 0.871 | |
| | | Have the ability to lead | 0.0388 | 2 | 0.03 | | |
| | | Have the ability to judge | 0.0346 | 4 | 0.03 | | |
| | | Ability to organize sports competitions | 0.0388 | 2 | 0.02 | | |

| | | | | | |
|---|--|--------|---|------|-------|
| | Have the capacity of prevention of accident and emergency counseling | 0.0357 | 3 | 0.03 | |
| | Physical appearance and physical fitness of PE teachers | 0.0309 | 5 | 0.02 | |
| | Understanding of Sports Venue Planning | 0.0219 | 6 | 0.02 | |
| Teacher's Counseling Communication Skills | Help students develop good sports habits | 0.0464 | 1 | 0.01 | 0.813 |
| | Ability to coordinate communication with colleagues | 0.0268 | 4 | 0.04 | |
| | Ability to coordinate communication with counselors and administrators | 0.0327 | 3 | 0.06 | |
| | Support the school spirit | 0.0420 | 2 | 0.05 | |
| Teaching methods | Using various kinds of teaching media to improve the effect on teaching; | 0.0484 | 4 | 0.03 | 0.883 |
| | Pay attention to the individual differences of students and teach students in accordance with their aptitude | 0.0722 | 1 | 0.04 | |
| | Good at sports demonstration | 0.0562 | 3 | 0.01 | |
| | Good at stimulating students' interest and motivation | 0.0621 | 2 | 0.03 | |

3.3 Hierarchical analysis and verification of the system of evaluation of professional skills

In this paper, the system is divided into three parts (Table 2), which are analyzed and examined on the basis of the system of evaluation. From Table 2, it can be seen that the professional skills of higher vocational physical education teachers are composed of three levels. The three levels of index elements not only fully reflect the professional skills system of higher vocational physical education teachers, but also reflect the basic characteristics of the three levels of professional skills of higher vocational physical education teachers. Among them, the third element of the professional skills system of higher vocational physical education teachers is the microscopic element that constitutes the professional skills of higher vocational physical education teachers.

Taking the professional technique of higher vocational PE teachers as the carrier, this paper adopts the analytic hierarchy process (AHP) to determine the importance and weight of 25 indexes

of 5 parts and 3 layers of the system of evaluation of PE teachers' professional technique. Kendall coefficient of concordance was used to test the reliability of weight evaluation subjects.

3.3.1 The steps of applying analytic hierarchy process to analyze the professional skills of PE teachers in higher vocational colleges

1) Establish a professional skills evaluation index system for higher vocational physical education teachers (as shown in Table 2)

2) Weight calculation and consistency testing

(1) Construct a judgment matrix: (b3 for example) ask experts to score, and then add the average of the experts' b3 Matrix:

$$b3 = \begin{bmatrix} 1 & 3 & 2 & 2 & 1/3 & 1/3 & 4 \\ 1/3 & 1 & 2 & 2 & 1/3 & 2 & 4 \\ 1/2 & 1/2 & 1 & 1/2 & 1/5 & 4 & 4 \\ 1/2 & 1/2 & 2 & 1 & 1/4 & 1/3 & 3 \\ 3 & 3 & 5 & 4 & 1 & 3 & 5 \\ 3 & 1/2 & 1/4 & 3 & 1/3 & 1 & 3 \\ 1/4 & 1/4 & 1/4 & 1/3 & 1/5 & 1/3 & 1 \end{bmatrix}$$

(2) Calculate the weight vector and perform a consistency test (take b3 as an example) is the pairwise comparison matrix constructed above reasonable? Consistency tests are performed. According to the analytic hierarchy process, the concordance index is:

$$\lambda = \frac{1}{n} \sum_{i=1}^n \frac{AW_i^{(2)}}{W_i^{(2)}} = 7.1697$$

$$CI = \frac{\lambda - n}{n - 1} = \frac{7.1697 - 7}{7 - 1} = \frac{0.1697}{6} = 0.0282$$

The random consistency index ri value according to the table (see b3 for example) to obtain 1.32

if consistent ratio $CR = \frac{CI}{RI} = \frac{0.0282}{1.32} = 0.021 < 0.10$

The degree of inconsistency of b3 is in the allowable range, and its characteristic vector can be used as the weight vector. So b3 passed the consistency test. b1, b2, b4, and b5 were tested for consistency by the same method, and were also fully passed (see Table 2 for data).

3.3.2 Using the Kendall Harmony Coefficient to test the reliability of survey results

The Kendall harmony coefficient is a calculation method which expresses the correlation degree of multi-rank variables by the principle of mathematical statistics. First of all, ask the relevant experts to give a score for the credibility of the results of this survey, the scoring standard is "very good, good, average, poor, very poor," respectively, with the numbers "5, 4, 3, 2, 1." Because the rater has the same grade to each factor survey result, the author uses the calculation method of Kendall harmony coefficient with the same grade to calculate. The Kendall Harmony Coefficient for raters with the same rating is calculated as follows:

$$W = \frac{\sum R_i^2 - \frac{(\sum R_i)^2}{N}}{\frac{1}{12} K^2 (N^3 - N) - K \sum T} \quad (1)$$

$$T = \frac{n^3 - n}{12} \quad (2)$$

In Formula (1), W is the Kendall Harmony Coefficient, K is the number of raters, N is the number of subjects evaluated, R_i is the sum of the grades of the i element.

Now take the calculation of the results of the survey on the teaching attitude of physical

education teachers as an example to illustrate the calculation method of subject reliability. The following table is the scoring data of six experts A, B, C, D, E and F on the five tertiary elements of physical education teaching:

Table 3. Raw data of six experts's scores for five tertiary factors

| | Compliance with educational laws and regulations | Classes on time and no dragging and no leaving early | Do not transfer classes without reason, do not leave at random | Love the PE teacher career | Teacher's noble morality plays an exemplary role in front of students |
|---|--|--|--|----------------------------|---|
| A | 5 | 4 | 4 | 3 | 3 |
| B | 4 | 4 | 3 | 3 | 2 |
| C | 5 | 4 | 3 | 4 | 4 |
| D | 5 | 5 | 4 | 4 | 5 |
| E | 5 | 5 | 3 | 4 | 4 |
| F | 5 | 5 | 4 | 5 | 4 |

The evaluation was carried out by the method of first qualitative and then sorting, and the final evaluation was carried out. The evaluation was divided into five grades: very good, good, general, poor and very poor. The evaluation results were transformed from the data in Table 3 to Table 4.

Table 4. Results of six expert ratings

| | Compliance with educational laws and regulations | Classes on time and no dragging and no leaving early | Do not transfer classes without reason, do not leave at random | Love the PE teacher career | Teacher's noble morality plays an exemplary role in front of students |
|---|--|--|--|----------------------------|---|
| A | very good | good | good | average | average |
| B | good | good | average | average | poor |
| C | very good | good | average | good | good |
| D | very good | very good | good | good | very good |
| E | very good | very good | average | good | good |
| F | very good | very good | good | very good | good |

Explanation: (1) The evaluation results in Table 4 are converted into rank orders. Rank orders are 1, 2, 3, 4, 5, and assignments are 5, 4, 3, 2, 1. Expert A evaluates the five factors as very good, good, good, average and average respectively, then the good rank assignment is 5, the good rank assignment is $(4 + 3) / 2 = 3.5$, and the general rank assignment is $(2 + 1) / 2 = 1.5$; Expert B evaluates the five factors as good, good, average, average and poor respectively, then its good rank assignment is $(5 + 4) / 2 = 4.5$, and its general rank assignment is $(3 + 2) / 2 = 2.5$; In the same way, the remaining rank assignment can be obtained. The data in Table 2 can be obtained by combining the above data and calculating R_i , R_i^2 and $\sum R_i^2$

(2) Calculating T and $\sum T$

The calculation is performed using formula (2), where n in formula (2) represents the number of the same grade. Expert A rated both factors 3.5 and the other two indicators 1.5, so

$$n_1 = 2, n_2 = 2, T_A = \frac{2^3 - 2}{12} + \frac{2^3 - 2}{12} = 1$$

For the same, $T_B = 1, T_C = 1, T_D = 2, T_E = 1, T_F = 2.5$, then

$$\sum T = 1 + 1 + 1 + 2 + 1 + 2.5 = 8.5$$

(3) Calculating W

$$W = \frac{1809.5 - \frac{90^2}{5}}{\frac{1}{12} \times 6^2 \times (5^3 - 5) - 6 \times 8.5} = 0.613$$

(4) Significance test of W

The Chakendall Harmony Coefficient Critical Value Table, when $K=6$, $N=5$, it is a small sample, the test unimetric is $S = \sum R_i^2 - \frac{(\sum R_i)^2}{N} = 1809.5 - \frac{90^2}{5} = 189.5$

Check "Kendall Harmony Coefficient (W) Significance Critical Table" shows that when $K=5$, the intermediate value is 136.1, that is $S=189.5 > S_{0.05}=136.1$, has significant significance.

It can be seen that the Kendall harmony coefficient is 0.613, and the results of this survey have good consistency and satisfactory reliability.

4. Conclusions and recommendations

4.1 System of evaluation values-oriented observation of higher vocational teaching

In this paper, the system of evaluation of PE teachers in higher vocational colleges is set up by means of qualitative and quantitative analysis. According to the professional skills belonging to higher vocational physical education teachers are divided into five categories: preparation before class and curriculum planning, teaching attitude, teachers' physical education professional ability, teachers' counseling and communication ability, teaching methods. The system of evaluation of PE teachers in higher vocational colleges has the characteristics of orientation, which fully ensures the effectiveness and practicability of the system.

4.2 Evaluation indicators to form a linkage effect of the overall design

In the system of evaluation of PE teachers in higher vocational colleges: teaching preparation, rich content, novel teaching materials; Love the profession of physical education teacher; Athlete level, education and scientific research ability; Counseling students to cultivate good physical education habits and pay attention to the individual differences of students teaching in accordance with their aptitude and other five higher vocational physical education teacher professional skills index weight value is high, indicating that these five indicators of higher vocational physical education teacher professional skills to improve the very important significance. Through the analytic hierarchy process result table, we can find the weak links of professional skills of higher vocational physical education teachers. Then, the weak professional skills of higher vocational physical education teachers are purposeful, targeted and directed to improve, of course, this evaluation index system has certain pertinence for the professional skills evaluation of higher vocational physical education teachers. Higher vocational colleges can adjust some items and contents according to their own actual situation, and establish a system of evaluation in line with the school.

4.3 Evaluation Index System to Promote Teaching Ability to Empower Teaching

Under the background of "Three Education Reform," the construction of professional skills evaluation index system of higher vocational physical education teachers aims to strengthen the weak links of professional skills of physical education teachers, promote professional skills of physical education teachers, and empower teaching quality. Consequently, the construction of this index system holds significant practical value, offering substantial utility and reference for evaluating and enhancing the professional skills of higher vocational physical education teachers. The system of evaluation of PE teachers in higher vocational colleges and the weightings of 25 evaluation indexes in the system have passed the test of Kendall's harmony and reliability, which is scientific, effective and universal. It is of practical significance to improve the evaluation system of higher vocational physical education teachers, promote the development of professional skills of higher vocational physical education teachers, and promote the teaching quality of higher

vocational physical education teachers.

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