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Research of Comprehensive Evaluation System on University Sports Work in China Based on AHP and Fuzzy Method

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Abstract

Comprehensive evaluation of college physical education system is a complex and systematic work, different universities types, different evaluation factors, and each factor is mutual interleaving, the logic relation is disorderly, the evaluation subject is fuzzy, but the level structure is cl ear. Traditional AHP evaluation method is limited, it can only build evaluation system and calculate the weight, but lack of quantitative evaluation results and the practicability of evaluation system is not strong. The article is proposing a comprehensive evaluation method of AHP and FUZZY (Analytic Hierarchy Process and Fuzzy Mathematics). Taking the sports work in universities as the research object. From 7 dimensions, 37 indicators and 5 evaluation bodies to form a three-dimensional comprehensive evaluation system. Evaluation process is not only consider the evaluation index of the multi-dimensional, but also the level of the subject. Evaluation results are intuitive, easy to understand, simple, accurate and reliable. The scientific evidence can be provided for the reform of college physical education, policy formulation, development strategy, and future planning.

Keywords: *New Era, AHP-FUZZY, University sports, Comprehensive evaluation*

1. Introduction

General Secretary Xi Jinping pointed out in his report at the 20th National Congress of the Communist Party of China that by 2035, a sports power will be built (Xi, 2022). On October 15, 2020, the General Office of the Central Committee of the Communist Party of China and the General Office of the State Council issued the "Opinions on Comprehensively Strengthening and Improving School Physical Education in the New Era" and the "Opinions on Comprehensively Strengthening and Improving School Aesthetic Education in the New Era" (Central People's Government of the People's Republic of China, 2020). In recent years, with the implementation of the strategy of national fitness, healthy China, and sports power, General Secretary Xi Jinping has repeatedly made special speeches, instructions, and instructions on

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sports work. The Party Central Committee, the State Council and relevant ministries and commissions have also issued a series of relevant policies, notices and documents. As an important position of sports work, the sports work of colleges and universities has attracted the attention of the government, schools and society. It is certain that after decades of development, our country's university sports work has made great progress in teacher allocation, venue construction, curriculum construction, student competitions, and financial investment, but there are also many problems. However, as far as policies are concerned, many policies are guiding and programmatic documents, which lack evaluation and inspection functions, which restricts the process of sports work in our country's universities. At present, the physical education work in colleges and universities in many places has "documents", "policies", and "institutions"; The embarrassing situation of "no evaluation", "no result" and "no feedback". It can be said that physical education in colleges and universities is the top priority of school sports work, an important carrier for implementing moral cultivation, a path and means for spreading socialist core values, a central link in school physical education, an important way to implement quality education and cultivate all-round development talents, and the last link in the cultivation of awareness and behavior of systematic physical education for life.

2. Literature Review

At present, the research results of physical education in our country are fruitful, mainly reflected in the following aspects: first, the physical education curriculum (Guo *et al.*, 2014; Jing *et al.*, 2002; Li *et al.*, 2014); second, the teaching of physical education (Xu, 2012; Xu *et al.*, 2010); third, the physical education teaching environment (Yang and Liu, 2010); fourth, the ability of physical education teachers (Chen and Zhou, 2010; Zhou, 2009; Tang, 2009); Fifth, sports scientific research (Sheng and Zhao, 2010). Judging from the collected data, although there are many and large number of research results in the evaluation of sports work in our country, they lack integrity and timeliness. In recent years, Wang *et al.* (2009) have studied the evaluation method based on Fuzzy-AHP; Chen and Li (2011). Comprehensive evaluation of ecosystem service functions of Jinping first-level reservoir based on AHP-FUZZY method; Yang and Feng (2011). Research on the allocation of funds for R&D projects based on AHP-FUZZY evaluation; Liu (2012). Evaluation of the quality of environmental information disclosure of listed companies based on the AHP-Fuzzy method; Li *et al.* (2015). The research on the evaluation of sports culture in colleges and universities based on fuzzy comprehensive evaluation provides good theoretical and methodological support for this paper. In view of this, this study focuses on ordinary undergraduate colleges recognized by the state (excluding sports colleges/departments). The AHP-FUZZY method is used to evaluate the sports work of colleges and universities in our country, in order to provide a scientific basis for the reform of sports work in colleges and universities in the new era, and promote the healthy and sustainable development of sports in colleges and universities.

3. Comprehensive Evaluation Ideas of College Sports Work by AHP-FUZZY Method

3.1. Comprehensive Evaluation System Structure of College Sports Work

The comprehensive evaluation system of college sports work is a complex and systematic work, and the target layer of evaluation is the overall situation of college sports work. Through expert interviews and questionnaire surveys, this paper has consulted 35 domestic experts who have been engaged in university sports research for many years. The collected indicators are counted, screened and processed, and finally 37 index systems involving 7 dimensions involving system construction, curriculum teaching, competition training activities, physical fitness monitoring, basic guarantee, scientific research management, and campus culture are obtained. The weight of the evaluation index was analyzed by AHP analysis. The evaluation subjects include experts, leaders, teachers, students, and parents, and the weight of the evaluation subjects is calculated according to the AHP principle. The final formation of the comprehensive evaluation of sports work in colleges and universities is mainly reflected in several aspects: 1. The multi-dimensional evaluation indicators and the hierarchical relationship between the indicators, and the index system is divided into target layer, criterion layer, and index layer. 2. The multi-subject evaluation object should change the traditional single evaluation mode of experts, leaders, teachers, students, and parents, and the comprehensive evaluation will give weight to all five evaluation subjects into the evaluation system. 3. The evaluation criteria adopt five levels of "very good", "good", "average", "poor", and "very poor", and all five grade standards are adopted to minimize data distortion. The final comprehensive evaluation system for physical education work in colleges and universities is an integrated evaluation system with multi-dimensional, comprehensive indicators, clear hierarchies, and three-dimensional structure.

3.2. Evaluation of AHP Index System for College Sports Work

AHP (Analytic Hierarchy Process) (Zhang, 2014), this method is a decision-making method that decomposes the elements that are always related to decision-making into goals, criteria, schemes, etc., and conducts qualitative and quantitative analysis on this basis. Basic steps:

(1) $W_i = (\prod_{j=1}^{n} a_{ij})^{\frac{1}{n}} (i = 1, 2, ..., n)$.

(2) Normalize the vector $W = [W_1, W_2, ..., W_4]^T$. Based on the formula $W_i^0 = \frac{W_i}{\sum_{i=1}^{n} W_i}$, it is calculated $W = [W_1^0, W_2^0, W_3^0, W_4^0]$ separately.

(3) The largest feature root of the judgment matrix $\lambda_{\max} = \sum_{i=1}^{n} \frac{(AW)_i}{nW_i}$ in the equation, $(AW)_i$ represents the i^{th} object of the vector AW.

(4) Consistency inspection.

Computation formula: $CI = \frac{\lambda_{\max} - n}{n-1}$. Where n is the order of the judgment matrix. Calculate the random consistency ratio: $CR = \frac{CI}{RI} < 0.10$, the consistency test passes. The evaluation index system and weights are shown in Table 1, and the calculation process is omitted.

3.3. FUZZY Fuzzy Comprehensive Evaluation of College Sports Work (Wang, 2011; Zheng, 2008)

3.3.1. Construct Indicators and Evaluation Subjects

Construct the first-level evaluation index for the comprehensive evaluation of sports work in ordinary colleges and universities, recorded it as $U = \{u_1, u_2, u_3, ..., u_n\}$. The first-level indicators are subdivided into second-level indicators, which are recorded as $V_i = \{v_{i1}, v_{i2}, v_{i3}, ..., v_{im}\}$, $(i = 1, 2, \ldots, n)$, each index is evaluated as t, recorded as $P = \{p_1, p_2, p_3, ..., p_n\}$. Set the evaluation subject as S, recorded as $B = \{b_1, b_2, b_3, ..., b_s\}$.

3.3.2. Weight Distribution

The comprehensive evaluation weights of sports work in colleges and universities are: first-level index weight, second-level index weight, and evaluation subject weight.

3.3.2.1. The Weight of the First-Level Indicator

The weight allocation vector of the first-level evaluation index is written as $Q = \{q_1, q_2, q_3, ..., q_n\}$, corresponding to the first-level evaluation index set $U = \{u_1, u_2, u_3, ..., u_n\}$, Q is the fuzzy subset of U. Among them, $q_{i \geq 0}$, $\sum_{i=1}^{n} q_i = 1$

3.3.2.2. Secondary Indicator Weight

Let the weight allocation vector of the second-level indicator of the i^{th} first-level indicator be written as $Q_i = \{q_{i1}, q_{i2}, q_{i3}, ..., q_{im}\}$, $(i = 1, 2, ..., n)$, corresponding to the second-level indicator set $V_i = \{v_{i1}, v_{i2}, v_{i3}, ..., v_{im}\}$, $(i = 1, 2, ..., n)$, Q_i is the fuzzy subset of V_i. Among them, $q_{ij \geq 0}$, $\sum_{j=1}^{m} q_{ij} = 1$. When the model is applied, the weight allocation vector is operated as a matrix.

3.3.2.3. Evaluate the Weight of the Subject

Let the evaluation subject weight allocation vector be written as $W = \{w_1, w_2, w_3, ..., w_s\}$, corresponding to the evaluation set $B = \{b_1, b_2, b_3, ..., b_s\}$, W, is the fuzzy subset of B. $w_{i>0}$, $\sum_{i=1}^{s} w_i = 1$.

3.4. AHP-FUZZY Comprehensive Evaluation Process for College Physical Education

Construct the fuzzy relation matrix S_i for the first-level indicator $u_i.v_{ij}$. The i^{th} second-level indicator in the i^{th} first-level where $i = 1, 2, ..., n$ and $j = 1, 2, ..., m$.

r_{ijk}: Secondary indicators v_{ij}, membership degrees on k grades, $k = 1, 2, \ldots, t$.

s_{ik}: First-level indicators u_i, membership degrees on k grades, $k = 1, 2, \ldots, t$.

Affiliation matrix of secondary indicators v_{ij}:

$$R = \begin{bmatrix} r_{i11} & r_{i12} & \cdots & r_{i1t} \\ r_{i21} & r_{i21} & \cdots & r_{i2t} \\ \cdots & \cdots & \cdots & \cdots \\ r_{im1} & r_{im2} & \cdots & r_{imt} \end{bmatrix}$$

The fuzzy relationship matrix $S_i = Q_i R_{ij}$ of the evaluation level t of the first-level index u_i can be obtained, namely:

$$S_i = Q_i R_{ij} = (q_{i1}, q_{i2}, ..., q_{im}) \begin{bmatrix} r_{i11} & r_{i12} & \cdots & r_{i1t} \\ r_{i21} & r_{i22} & \cdots & r_{i2t} \\ \cdots & \cdots & \cdots & \cdots \\ r_{im1} & r_{im2} & \cdots & r_{imt} \end{bmatrix} = (s_{i1}, s_{i2}, ..., s_{it})$$

Then all first-level indicators $U = \{u_1, u_2, u_3, ..., u_n\}$. The fuzzy relation matrix corresponding to t evaluation grades is donated as S,

$$S = \begin{bmatrix} s_{11} & s_{12} & \cdots & s_{1t} \\ s_{21} & s_{21} & \cdots & s_{2t} \\ \cdots & \cdots & \cdots & \cdots \\ s_{n1} & s_{n2} & \cdots & s_{nt} \end{bmatrix}$$

Establish a fuzzy relationship matrix for the comprehensive evaluation of university physical education work with respect to t evaluation grades

$$F = QS = (q_1, q_2, ..., q_n) \begin{bmatrix} s_{11} & s_{12} & \cdots & s_{1t} \\ s_{21} & s_{22} & \cdots & s_{2t} \\ \cdots & \cdots & \cdots & \cdots \\ s_{n1} & s_{n2} & \cdots & s_{nt} \end{bmatrix} = (f_1, f_2, ..., f_t)$$

The relationship between evaluation subjects is fuzzy.

There is a matrix of fuzzy relationships F for each evaluation subject, an evaluation subject can obtain s fuzzy relation matrices $F_1, F_2, \ldots, F_s$, which form a fuzzy relation matrix set:

$$\mathrm{D} = \mathrm{W} \begin{bmatrix} f_{11} & f_{12} & \cdots & f_{1t} \\ f_{21} & f_{22} & \cdots & f_{2t} \\ \cdots & \cdots & \cdots & \cdots \\ f_{n1} & f_{n2} & \cdots & f_{nt} \end{bmatrix} = (w_1, w_2, ..., w_n) \begin{bmatrix} f_{11} & f_{12} & \cdots & f_{1t} \\ f_{21} & f_{22} & \cdots & f_{2t} \\ \cdots & \cdots & \cdots & \cdots \\ f_{n1} & f_{n2} & \cdots & f_{nt} \end{bmatrix} = (d_1, d_2, ..., d_t)$$

According to the principle of fuzzy mathematics, the evaluation result is (d_1, d_2, ..., d_t). The evaluation score can be obtained by assigning points to the evaluation level set.

4. The Comprehensive Evaluation and Application of AHP-FUZZY Method in College Physical Education

According to the above steps and evaluation principles, 140 copies of the comprehensive evaluation scale for college physical education work are distributed to experts, leaders, teachers, students, and parents who are familiar with ×× colleges and universities, 135 copies have been collected, and 127 copies that meet the standards have been sorted out, including 35 experts, 26 leaders, 16 teachers, 37 students, and 13 parents.

According to Table 1, the membership matrix of all secondary indicators is obtained

$$R_1=\begin{bmatrix}0.06 & 0.11 & 0.37 & 0.26 & 0.20\\ 0.06 & 0.20 & 0.51 & 0.14 & 0.09\\ 0.09 & 0.11 & 0.20 & 0.34 & 0.26\\ 0.06 & 0.11 & 0.26 & 0.37 & 0.20\\ 0.26 & 0.11 & 0.31 & 0.17 & 0.14\\ 0.11 & 0.14 & 0.40 & 0.26 & 0.09\end{bmatrix}\quad R_2=\begin{bmatrix}0.26 & 0.34 & 0.23 & 0.11 & 0.06\\ 0.23 & 0.37 & 0.17 & 0.14 & 0.09\\ 0.14 & 0.40 & 0.23 & 0.17 & 0.06\\ 0.06 & 0.11 & 0.37 & 0.29 & 0.17\\ 0.09 & 0.11 & 0.40 & 0.26 & 0.14\end{bmatrix}$$

$$R_3=\begin{bmatrix}0.29 & 0.43 & 0.17 & 0.09 & 0.03\\ 0.03 & 0.11 & 0.14 & 0.23 & 0.49\\ 0.11 & 0.09 & 0.37 & 0.23 & 0.20\\ 0.06 & 0.11 & 0.26 & 0.40 & 0.17\\ 0.09 & 0.09 & 0.37 & 0.26 & 0.20\end{bmatrix}\quad R_4=\begin{bmatrix}0.37 & 0.29 & 0.17 & 0.11 & 0.06\\ 0.03 & 0.14 & 0.40 & 0.26 & 0.17\\ 0.46 & 0.29 & 0.14 & 0.09 & 0.03\\ 0.03 & 0.09 & 0.23 & 0.26 & 0.40\\ 0.03 & 0.06 & 0.09 & 0.37 & 0.46\end{bmatrix}$$

$$R_5=\begin{bmatrix}0.14 & 0.46 & 0.23 & 0.11 & 0.06\\ 0.49 & 0.26 & 0.11 & 0.09 & 0.06\\ 0.06 & 0.09 & 0.17 & 0.20 & 0.49\\ 0.03 & 0.06 & 0.11 & 0.34 & 0.46\\ 0.09 & 0.14 & 0.49 & 0.17 & 0.11\\ 0.06 & 0.11 & 0.37 & 0.26 & 0.20\end{bmatrix}\quad R_6=\begin{bmatrix}0.03 & 0.06 & 0.29 & 0.49 & 0.14\\ 0.03 & 0.06 & 0.14 & 0.57 & 0.20\\ 0.06 & 0.20 & 0.37 & 0.23 & 0.14\\ 0.03 & 0.09 & 0.23 & 0.60 & 0.06\\ 0.06 & 0.14 & 0.17 & 0.40 & 0.23\end{bmatrix}$$

$$R_7=\begin{bmatrix}0.26 & 0.11 & 0.17 & 0.37 & 0.09\\ 0.03 & 0.17 & 0.49 & 0.17 & 0.14\\ 0.06 & 0.09 & 0.26 & 0.43 & 0.17\\ 0.03 & 0.09 & 0.17 & 0.46 & 0.26\\ 0.03 & 0.09 & 0.20 & 0.46 & 0.23\end{bmatrix}$$

Weighted vector by 7 first-level indicators Q_1 = (0.27, 0.12, 0.18, 0.13, 0.09, 0.21); Q_2 = (0.28, 0.25, 0.12, 0.21, 0.14); Q_3 = (0.27, 0.16, 0.15, 0.23, 0.19); Q_4 = (0.27, 0.15, 0.25, 0.10, 0.23); Q_5 = (0.22, 0.12, 0.17, 0.11, 0.10, 28); Q_6 = (0.31, 0.23, 0.14, 0.15, 0.17); Q_7 = (0.21, 0.33, 0.21, 0.14, 0.11). Fuzzy relationship vectors S_1, S_2, S_3, S_4, S_5, S_6, S_7 with 7 first-level indicators and 5 evaluation levels can be obtained.

That is, the fuzzy evaluation matrix of the secondary indicator “system construction”:

Table 1: List of Comprehensive Evaluation Index Systems for Physical Education Work in Ordinary Colleges and Universities (Expert Group)

	First-Level Indicators	Secondary Indicators	Evaluation Level				
			Good	Better	So So	Worse	Poor
A Fuzzy comprehensive evaluation model for university sports work	System construction (0.20)	Conscientiously implement the national sports development plan and implement relevant legal regulations (0.27)	0.06	0.11	0.37	0.26	0.20
		Formulate, publish, and implement the "Implementation Plan for Physical Education and Health Curriculum" (0.12)	0.06	0.20	0.51	0.14	0.09
		School sports safety management, campus accident injury series management system (0.18)	0.09	0.11	0.20	0.34	0.26
		School sports work objective assessment, work rewards and punishments, and administrative accountability mechanisms (0.13)	0.06	0.11	0.26	0.37	0.20
		The establishment of sports work institutions shall implement the responsibilities of school leaders (0.09)	0.26	0.11	0.31	0.17	0.14
		The overall planning of school sports work funds (0.21)	0.11	0.14	0.40	0.26	0.09
	Curriculum teaching (0.17)	Standardize the implementation of the compulsory physical education course standards for first- and second-year undergraduate students (0.28)	0.26	0.34	0.23	0.11	0.06
		The physical education curriculum is scientifically arranged and the curriculum is sufficient (0.25)	0.23	0.37	0.17	0.14	0.09
		The content and interests of physical education classes are in line with students' physical and mental development (0.12)	0.14	0.40	0.23	0.17	0.06
		Promote the active reform of physical education and health courses and keep pace with the times (0.21)	0.06	0.11	0.37	0.29	0.17
		Student sports satisfaction, participation rate (0.14)	0.09	0.11	0.40	0.26	0.14
	Competition training activities (0.12)	Establish and improve the student sports competition system, and actively respond to the call of higher departments (0.27)	0.29	0.43	0.17	0.09	0.03
		Do a good job of extracurricular sports activities for all students in the school for 1 hour a day and 3 times a week (0.16)	0.03	0.11	0.14	0.23	0.49
		Each graduate has mastered at least 2 lifelong physical exercise projects (0.15)	0.11	0.09	0.37	0.23	0.20
		Organize spring and autumn comprehensive student sports meetings every year (0.23)	0.06	0.11	0.26	0.40	0.17
		Support teachers and students to participate in domestic and foreign sports competitions (0.19)	0.09	0.09	0.37	0.26	0.20
	Physical fitness monitoring (0.18)	Do a good job in student physical fitness testing and reporting (0.27)	0.37	0.29	0.17	0.11	0.06
		Formulate a comprehensive evaluation system for student physical fitness monitoring (0.15)	0.03	0.14	0.40	0.26	0.17
		Set up a student physical health monitoring institution (0.25)	0.46	0.29	0.14	0.09	0.03
		The "National Student Physical Health Standards" score management system (0.10)	0.03	0.11	0.23	0.26	0.40
		Research on the intervention mechanism of students' physical health (0.23)	0.03	0.06	0.09	0.37	0.46
	Basic guarantee (0.19)	Construction of professional physical education teachers (0.22)	0.14	0.46	0.23	0.11	0.06
		Physical education teacher titles, academics, job appointments, personal training and other system construction (0.12)	0.49	0.26	0.11	0.09	0.06
		The remuneration system for physical education, extracurricular sports activities, and training competitions (0.17)	0.06	0.09	0.17	0.20	0.49
		Operation of sports venues (halls) (0.11)	0.03	0.06	0.11	0.34	0.46
		Standardize the sports equipment management system (0.10)	0.09	0.14	0.49	0.17	0.11
		Per capita sports venues and financial investment; Ratio of teachers and students in physical education (0.28)	0.06	0.11	0.37	0.26	0.20
	Scientific research management (0.08)	Scientific research system construction (0.31)	0.03	0.06	0.29	0.49	0.14
		Project approval (0.23)	0.03	0.06	0.14	0.57	0.20
		Publication of papers (0.14)	0.06	0.20	0.37	0.23	0.14
		Participation in academic conferences at home and abroad (0.15)	0.03	0.09	0.23	0.60	0.06
		Published textbooks, monographs and other achievements (0.17)	0.06	0.14	0.17	0.40	0.23
	Campus culture (0.07)	Support students in departments and classes to carry out sports competitions and cultural festivals (0.21)	0.26	0.11	0.17	0.37	0.09
		Actively form teams to participate in group sports competitions inside and outside the school (0.33)	0.03	0.17	0.49	0.17	0.14
		The school has set up sports clubs to promote sports culture in various ways (0.21)	0.06	0.09	0.26	0.43	0.17
		Create a sports culture atmosphere and popularize sports science knowledge (0.14)	0.03	0.09	0.17	0.46	0.26

$$S_1 = \mathrm{Q}_1 R_1 = (0.27,0.10,0.18,0.13,0.09,0.21)\begin{bmatrix} 0.06 & 0.11 & 0.37 & 0.26 & 0.20 \\ 0.06 & 0.20 & 0.51 & 0.14 & 0.09 \\ 0.09 & 0.11 & 0.20 & 0.34 & 0.26 \\ 0.06 & 0.11 & 0.26 & 0.37 & 0.20 \\ 0.26 & 0.11 & 0.31 & 0.17 & 0.14 \\ 0.11 & 0.14 & 0.40 & 0.26 & 0.09 \end{bmatrix}$$

S_1 = (0.12, 0.15, 0.27, 0.26, 0.20), in the same way, it can be obtained S_2 = (0.22, 0.24, 0.20, 0.18, 0.15); S_3 = (0.22, 0.24, 0.20, 0.18, 0.15); S_4 = (0.23, 0.23, 0.15, 0.20, 0.20); S_5 = (0.13, 0.20, 0.25, 0.23, 0.18); S_6 = (0.06, 0.14, 0.29, 0.31, 0.20); S_7 = (0.19, 0.16, 0.30, 0.19, 0.16). From this, the comprehensive evaluation matrix of the expert group on the sports work of colleges and universities can be obtained:

$$F_{\text{expert}} = \mathrm{QS} = (0.20,0.17,0.12,0.18,0.19,0.08,0.07)\begin{bmatrix} 0.12 & 0.15 & 0.27 & 0.26 & 0.20 \\ 0.22 & 0.24 & 0.20 & 0.18 & 0.15 \\ 0.22 & 0.24 & 0.20 & 0.18 & 0.15 \\ 0.23 & 0.23 & 0.15 & 0.20 & 0.20 \\ 0.13 & 0.20 & 0.25 & 0.23 & 0.18 \\ 0.06 & 0.14 & 0.29 & 0.31 & 0.20 \\ 0.19 & 0.16 & 0.30 & 0.19 & 0.16 \end{bmatrix}$$

= (0.19, 0.20, 0.21, 0.21, 0.21).

By analogy, the evaluation matrix can be obtained: F_{leads} = (0.02, 0.11, 0.31, 0.52, 0.04); $F_{teachers}$ = (0.03, 0.06, 0.26, 0.60, 0.06); $F_{students}$ = (0.09, 0.13, 0.27, 0.31, 0.20); $F_{parents}$ = (0.04, 0.12, 0.22, 0.49, 0.13). The evaluation matrix of experts, leaders, teachers, students, and parents is comprehensively obtained:

$$F = \begin{bmatrix} 0.19 & 0.20 & 0.21 & 0.21 & 0.21 \\ 0.02 & 0.11 & 0.31 & 0.52 & 0.04 \\ 0.03 & 0.06 & 0.26 & 0.60 & 0.06 \\ 0.09 & 0.13 & 0.27 & 0.31 & 0.20 \\ 0.04 & 0.12 & 0.22 & 0.49 & 0.13 \end{bmatrix}$$

According to the principle of maximum affiliation, it can be judged that the maximum affiliation of the comprehensive evaluation of sports work in ×× colleges and universities is 0.25, which is "poor". The elements in the comment set (good, better, average, poor, and poor) are assigned corresponding values, and the comprehensive evaluation can be converted into a percentage system. Good (100~91), good (90~81), fair (80~71), poor (70~61), poor (below 60). Since each grade is an interval value, the median value of the group is 95 good, 85 better, 75 average, 65 poor, and 55 poor.

$$G = R \times V = (0.16,0.17,0.23,0.25,0.18) \times \begin{bmatrix} 95 \\ 85 \\ 75 \\ 65 \\ 55 \end{bmatrix}$$

$= 0.16 \times 95 + 0.17 \times 85 + 0.23 \times 75 + 0.25 \times 65 + 0.18 \times 55$

= 74, then the final score of the evaluation is 74 points.

5. Discussion

The evaluation of physical education in colleges and universities is an important part of the scientific management of physical education, and it is a powerful measure to promote educational reform and improve the quality of education. Through evaluation, information can be provided to the higher leadership organs and education management departments in order to strengthen macro control and guidance, and the enthusiasm and creativity of physical education teachers can be mobilized. As of June 20, 2025, there are a total of 3,167 colleges and universities nationwide, including: 2,919 ordinary colleges and universities, including 1,365 undergraduate schools and 1,554 higher vocational (junior college) schools; 248 adult higher education schools. Ministry of Education (2025) and Wang Shuyan (2010), on the basis of the established evaluation index system for the implementation of school sports policy, takes ordinary middle schools in Heilongjiang Province as an example to use the established evaluation index system to comprehensively analyze and evaluate the current situation of school sports policy implementation. Wu and Chen (2010), analyzed the basic concept of school sports modernization evaluation, and constructed a school sports modernization evaluation system with 4 first-level indicators, including resource system, management system, effect system, and fairness system, and 34 second- and third-level indicators. Sheng and Zhao (2010) established a comprehensive evaluation index system for sports research in Beijing, and used factor analysis to divide the dimensions, verify the reliability and validity, and finally determined the weight coefficient of the index by AHP analytic hierarchy process and conducted field evaluation. Fang (2010) mainly used analytic hierarchy process and questionnaire survey method to conclude that the quality evaluation system of physical education teaching in colleges and universities includes 3 first-level indicators and 15 second-level indicators. Yang (2014) qualitatively analyzed the evaluation standards of school physical education courses based on postmodernist curriculum theory. Yan *et al.* (2014) used factor analysis to construct a policy performance evaluation index system for the "opening of school sports facilities" including 3 first-level indicators, 9 second-level indicators, and 32 third-level indicators, and established the weights of each level. The weighted evaluation method was used to conduct a comprehensive field evaluation of A Middle School in Baoying County, Yangzhou City. Li *et al.* (2015), using fuzzy comprehensive evaluation and analytic hierarchy process to construct an evaluation system for sports culture in colleges and universities, and through case analysis, the macro and micro, vertical and horizontal evaluation and test of the development of sports culture in colleges and universities are realized.

It can be seen that the research of physical education in our country has gradually changed from qualitative research based on one's own subjective experience and observation to quantitative research based on quantitative evaluation. Quantitative research methods have been diversified, such as grade evaluation method, standard integral evaluation method, full-weighted evaluation method, factor analysis method, fuzzy matrix evaluation method, etc. Unfortunately, most of the existing studies focus on a certain aspect or individual evaluation methods, and lack holistic and systematic characteristics. There is no doubt that in the face of such a huge university system, it is affected by geographical location, economy, history, culture and other factors. It is difficult to form a unified national evaluation standard and system for colleges and universities of different forms and types, and with the reform and development of international and domestic education work, the requirements of the times, and the emergence of sports work in the new era. All provinces, municipalities, and regions should use national guiding documents as the baton to formulate local or regional evaluation standards that are relatively in line with reality. In future research, it is obviously necessary to make up for this deficiency from a systematic perspective. Of course, the evaluation of physical education in colleges and universities is a complex process, including factors such as teachers, students, venues, and systems, some of which can be quantitatively measured, while others cannot be carried out, such as non-intellectual factors, such as students' interests, emotions, attitudes, behaviors, and habits. teachers' professional negligence, fatigue, competence, and work commitment; the leader's governing concept, work identity, and sports awareness; Parents' sports support, values, sports attention and other indicators cannot be measured by quantitative evaluation, and it is difficult to quantify. If these indicators are ignored, the evaluation of sports work will also be one-sided and unscientific. However, in order to promote the development of school sports, it is inevitable to conduct evaluation and find out the problems existing in sports work in colleges and universities. Therefore, the AHP-FUZZY combined evaluation method adopted in this paper is qualitative.

6. Conclusion

Through expert interviews and questionnaire surveys, the results of this paper show that the comprehensive evaluation of physical education work in ordinary colleges and universities in our country should be carried out from 7 dimensions and 37 indicators: system construction, curriculum teaching, competition training activities, physical fitness monitoring, basic support, scientific research management, and campus culture. Practice has proved that the 37 indicators can effectively reflect the overall situation of physical education work in ordinary colleges and universities, and the evaluation results are highly accurate and have practical value.

The traditional AHP evaluation method has great limitations, only constructing an evaluation system and calculating weights, lacking quantitative evaluation results, and the practicability of the evaluation system is not strong. In this paper, an AHP-FUZZY (analytic hierarchy-fuzzy mathematics) comprehensive evaluation method is proposed. The evaluation process of this method considers the multi-dimensional of the evaluation indicators and the hierarchical nature of the evaluation subject, and is a three-dimensional comprehensive evaluation system. The evaluation results are intuitive, easy to understand and simple, and the evaluation results are accurate and reliable.

The index system, index weight, and evaluation subject weight of comprehensive evaluation are highly representative by collating with relevant personnel engaged in sports in our country's universities. However, due to the differences in the research interests, research fields and own research capabilities of each survey subject; the differences in knowledge structure, region, gender, and cognition of the evaluation subject; In addition, the "first cause effect" and "halo effect" in the evaluation process will inevitably affect the final evaluation results.

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