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Basketball teaching quality-based comprehensive evaluation analysis and fuzzy mathematics comprehensive utilization

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ABSTRACT

With education constant popularization, universities teaching quality accordingly is in the declining trend, especially for sports teaching aspect, it is fraught with problems, in order to more scientific and normative regulate teaching management system, the paper makes basketball teaching comprehensive evaluation system, with an aim to improve basketball teaching level, excavate teachers' teaching potentials. By applying fuzzy mathematics way, it makes comprehensive evaluation on basketball teaching, and combines with examples verification, finally it gets evaluation result is normal or good such level, and final evaluation result is 79.61 scores that indicate basketball educational teaching quality still has great promotion space, universities should particularly focus on teachers' comprehensive levels in future teachers' selection process. Therefore it proves the model's validness and rationality as well as scientificity, which provides a good comprehensive evaluation platform for universities' basketball teaching.

KEYWORDS

Basketball teaching quality;
Comprehensive evaluation;
Fuzzy mathematics.

INTRODUCTION

For "teaching quality" such words, different people will use different understanding ways, for quality itself, it includes teaching efficiency, teaching methods, teaching contents and teaching attitude so on, with society requirement on talents quality being higher and higher, teaching quality is also accordingly in the dynamic status, so it needs to make comprehensive evaluation in one period so as to define such period teaching quality.

For teaching quality evaluation, formers have made lots of contributions, such as: Quan Xiao-Hong in teachers' teaching quality evaluation such article, she proposed a kind of evaluation system for contemporary university faculty educational features, and combined with experts' relative system indicators to analyze and research, used analytic hierarchy process method to define weights sizes, and further constructed comprehensive evaluation model based on fuzzy mathematics; Xu Lin in Chinese sports education basketball course teaching contents construction, he put forward heavy technology and light theory mode should be properly reduced, it should regard students as a kind of dynamic status to teach so that realized every student became all-around comprehensive talent; He Jun researched on Cheng Du city basketball teaching current status and influence aspects, and finally got presents in Cheng Du, young teachers occupied most of parts and teacher's

professional proficiency was higher, but students final results were so extreme that lack of comprehensive evaluation ways, meanwhile school should strengthen teaching contents' reform, optimize teaching methods and improve teaching quality.

The paper just on the basis of previous research, it makes comprehensive analysis of basketball teaching, uses mathematical statistics, analytic hierarchy process and other methods to research on it, the research will provide a guiding effect on improving universities' basketball teaching levels, and promote teaching quality.

FUZZY COMPREHENSIVE EVALUATION THEORY ESTABLISHMENTS

Use mathematical method to research and handle with fuzzy phenomenon's mathematics is fuzzy analysis. Nowadays, fuzzy analysis application has already widespread in social sciences' each field, which fully reflects its powerful vitality and seepage force. The model carries out comprehensive consideration and research on the premise that takes multiple factors into account, realizes relative reasonable evaluation effects, so we use fuzzy hierarchical analysis to make comprehensive evaluation on basketball teaching, its method and steps are as following:

At first, it should define evaluation objects, it is individual variable affected by y pieces of factors, and its factor set is q, which is defined as:

$$q = (q_{i,} q_i, q_i, \cdots, q_i) \quad (1)$$

And regulate:

$$q_i (i = 1, 2, 3, \cdots, y) \quad (2)$$

Due to each variable weight is different, defined evaluation grades impacts are also different, we assume that its weight allocation is q_i, and:

$$p_i = (p_{1,} p_2, p_3, \cdots p_y) \quad (3)$$

Among them:

$$p_i (i = 1, 2, 3, \cdots, y) \quad (4)$$

The above formula is formula(2) weight, according to common sense, we know $p_i \geq 0$ and:

$$\sum_{i=1}^{y} p_i = 1$$

If every factor p_i contains n pieces of sub factors, their factors set is:

$$q_i = (q_{i,1,} q_{i,2}, q_{i,3}, \cdots, q_{i,n}) \quad (5)$$

Then corresponding weight is:

$$p_i = (p_{i,1,} p_{i,2}, p_{i,3}, \cdots p_{i,n}) \quad (6)$$

To $q_{i,j}$ weight value p_i, according to common sense, it is known that $p_{i,j} \geq 0$ and:

$$\sum_{j=1}^{n} p_{i,j} = 1$$

Establish a evaluation indicator set as:

$$h = (h_{1,} h_2, h_3, \cdots, h_s) \quad (7)$$

Corresponding evaluation objects can be divided into s pieces of different grades, here, we let $h_{1,} h_2, h_3, \cdots, h_s$ to be each merit evaluation grade from high to low, such as excellent, good, qualified, and unqualified so on. By matrix compositional operating, it can get its corresponding basketball players' basketball performance evaluation results that:

$$c = p * r = (p_{1,} p_2, p_3, \cdots p_y) * (r_1, r_2, r_3, \cdots, r_y)^T$$

$$= (c_1, c_2, c_3, \cdots, c_y) \quad (8)$$

From fuzzy set c, we can utilize normalization processing to get a defined evaluation grade. Because:

$$H_k = \{H_I\} \quad (9)$$

Then H_K final evaluation result grade is k.

BASKETBALL TEACHING EVALUATION SYSTEM MODEL

In order to more reasonable establish a perfect basketball teaching quality comprehensive evaluation system, the paper selects 16 kinds of second grade indicators, four kinds of first grades as research objects, after that it gives different weights to every grade each indicator and makes quantization with it, defines evaluation criterion and then carries out comprehensive analysis of each indicator weight and evaluation criterion, and finally gets its final evaluation system, as following TABLE 1 show:

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TABLE 1: Basketball teaching quality evaluation indicator

The first layer	The second layer	The third layer
Teaching quality(W)	Teaching methods(W1)	Clear thought, correct concept, emphasis (W11)
		Focus on enlightening, sharp on mind, cultivate ability (W12)
		Performance and language refining extent(W13)
		Guide learning method, focus on improve teaching (W14)
	Teaching attitude(W2)	innovation, constantly improve teaching(W15)
		Patient tutoring, seriously correct homework (W16)
		Sufficient lessons preparation, proficient introduction (W17)
		Strict requirements, impart knowledge and educate people (W18)
	Teaching contents(W3)	Course schedule and learning load rationality judgment(W19)
		Compatibility of teaching materials processing (W20)
		Link theory and practice(W21)
		Fulfill syllabus requirements (W22)
	Teaching efficiency(W4)	Learning and problem-solving ability(W23)
		Test result (W24)
		Homework and test at ordinary times (W25)
		Classroom discipline (W26)

Weight defining

By above TABLE 1, we can know that due to sports teaching quality evaluation is decided by multiple factors, so the paper combines with previous experience and applies analytic hierarchy process to define each indicator weight size, its result is as following TABLE 2 show:

Evaluation criterion defining

In order to clarify basketball teaching each grade, the paper respectively selects five kinds of grades to analyze, it given that: unqualified is below 60 scores, qualified is from 60 scores to 69 scores, medium is from 70 scores to79 scores, good is from 80 scores to 89 scores, excellent is from 90 scores to 100 scores.

BASKETBALL TEACHING COMPREHENSIVE EVALUATION STEPS

Three layers evaluation

Due to each evaluation set every indicator needs to be evaluated, the paper firstly selects the third layer's first kind as evaluation object, in order to define evaluation grade, the paper selects 50 students to evaluate W11, their evaluation results is as following TABLE 3 show:

Let above evaluation result to be:

$$K^{s}_{11} = (0.50,\ 0.26,\ 0.20,\ 0.04,\ 0.00) \quad \textbf{(10)}$$

Apply above way, it can respectively solve F1 corresponding other three sub sets evaluation sets, that :

$$K^{s}_{12} = (0.47,\ 0.32,\ 0.18,\ 0.03,\ 0.00) \quad \textbf{(11)}$$

$$K^{s}_{13} = (0.11,\ 0.36,\ 0.30,\ 0.21,\ 0.02) \quad \textbf{(12)}$$

$$K^{s}_{14} = (0.03,\ 0.12,\ 0.52,\ 0.23,\ 0.10) \quad \textbf{(13)}$$

So, by above formula we can solve W1 single factor evaluation matrix, which is also:

$$K^{s}_{1} = \begin{bmatrix} 0.50 & 0.26 & 0.20 & 0.04 & 0.00 \\ 0.47 & 0.32 & 0.18 & 0.03 & 0.00 \\ 0.11 & 0.36 & 0.30 & 0.21 & 0.02 \\ 0.03 & 0.12 & 0.52 & 0.23 & 0.10 \end{bmatrix} \quad \textbf{(14)}$$

Two layers evaluation

Due to each indicator influence extent to last grade as well as emphasis extent to one indicator are different, the paper quotes weight concept, four sub indicators' weights on basketball teaching contents are respectively: $W_1(0.3)$, $W_2(0.2)$, $W_3(0.2)$, $W_4(0.3)$, and

TABLE 2 : Basketball teaching quality evaluation indicator weight table

The first layer	The second layer	Weight	The third layer	Weight
W	W_1	0.2733	W_{11}	0.2913
			W_{12}	0.2186
			W_{13}	0.1988
			W_{14}	0.2913
	W_2	0.2133	W_{21}	0.2534
			W_{22}	0.2001
			W_{23}	0.3066
			W_{24}	0.2401
	W_3	0.2400	W_{31}	0.2666
			W_{32}	0.2532
			W_{33}	0.1934
			W_{34}	0.28680
	W_4	0.2733	W_{41}	0.2999
			W_{42}	0.2134
			W_{43}	0.1944
			W_{44}	0.2932

then corresponding F_1 sub factors corresponding weights are respectively: W_{11}(0.4)、W_{12}(0.3)、W_{13}(0.2)、W_{14}(0.1); and corresponding fuzzy set is:

$A_1 = (0.4,\ 0.3,\ 0.2,\ 0.1)$

TABLE 3 : Students to W11 evaluation result table

Evaluation grade	Excellent	Good	Normal	Poor	Bad
Number of people	25	13	10	2	0
Percentage	0.50	0.26	0.20	0.04	0.00

TABLE 4: Teaching quality comprehensive evaluation summary sheet

Grade	Excellent	Good	Normal	Poor	Bad
Percentage	0.271	0.271	0.223	0.171	0.064

According to above process, similarly it can respectively solve other three kinds of fuzzy sets that are respectively:

$$A_2 = (0.3,\ 0.3,\ 0.2,\ 0.2)$$
$$A_3 = (0.3,\ 0.3,\ 0.2,\ 0.2)$$
$$A_4 = (0.4,\ 0.2,\ 0.3,\ 0.1)$$

Compound above each process weight with evaluation matrix, it can get basketball teaching comprehensive evaluation result B_i, the paper takes W1 as an example to illustrate, then it has:

$$\begin{aligned} P_1^s &= A_1 \cdot K^s{}_1 \\ &= (0.4,\ 0.3,\ 0.2,\ 0.1) * \begin{bmatrix} 0.50 & 0.26 & 0.20 & 0.04 & 0.00 \\ 0.47 & 0.32 & 0.18 & 0.03 & 0.00 \\ 0.11 & 0.36 & 0.30 & 0.21 & 0.02 \\ 0.03 & 0.12 & 0.52 & 0.23 & 0.10 \end{bmatrix} \\ &= (0.4,\ 0.3,\ 0.2,\ 0.2,\ 0.1) \end{aligned} \quad (15)$$

In order to better reflect each indicator mutual relations, above result needs to be normalized, then it can get:

$$\begin{aligned} P^s{}_1 &= \left(\frac{0.4}{1.2}, \frac{0.3}{1.2}, \frac{0.2}{1.2}, \frac{0.2}{1.2}, \frac{0.1}{1.2}\right) \\ &= (0.334,\ 0.251,\ 0.168,\ 0.168,\ 0.084) \end{aligned} \quad (16)$$

Similarly, it can handle with other three kinds with same steps, and respectively get result after normalization as:

$$\begin{aligned} P^s{}_2 &= (0.251,\ 0.416,\ 0.228,\ 0.105,\ 0.000) \\ P^s{}_3 &= (0.327,\ 0.328,\ 0.197\ 0.131,\ 0.021) \\ P^s{}_4 &= (0.188,\ 0.386,\ 0.284\ 0.114,\ 0.058) \end{aligned} \quad (17)$$

Therefore, we can get two layers' each indicator evaluation result matrix form, that:

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$$K^s = \begin{bmatrix} 0.334 & 0.251 & 0.168 & 0.168 & 0.084 \\ 0.251 & 0.416 & 0.228 & 0.105 & 0.000 \\ 0.327 & 0.328 & 0.197 & 0.131 & 0.021 \\ 0.188 & 0.386 & 0.284 & 0.114 & 0.058 \end{bmatrix} \quad (18)$$

One layer evaluation

Combine with above process and result, we can apply same method and steps to get the first layer evaluation result, we let above four kind of factors weight set to be:

$A = (0.3,\ 0.2,\ 0.2,\ 0.3)$

Similarly by above 50 students' comprehensive evaluation on basketball teaching quality, its result is:

$$P^s = A \cdot K^s = (0.3,\ 0.2,\ 0.2,\ 0.3) * \begin{bmatrix} 0.334 & 0.251 & 0.168 & 0.168 & 0.084 \\ 0.251 & 0.416 & 0.228 & 0.105 & 0.000 \\ 0.327 & 0.328 & 0.197 & 0.131 & 0.021 \\ 0.188 & 0.386 & 0.284 & 0.114 & 0.058 \end{bmatrix} \quad (19)$$

$= (0.300,\ 0.300,\ 0.283,\ 0.167,\ 0.083)$

Normalize its result, we get:

$P^s = (0.266,\ 0.266,\ 0.250\ ,0.148\ ,0.070)$

Above result shows that for basketball teaching, 7.0% students thought it to be "bad", 14.8% students thought it to be "poor", 25.0% students thought it to be "normal", 26.6% students thought it to be "good", 26.6% students thought it to be "excellent".

EVERY TEACHER, STUDENT TO TEACHING COMPREHENSIVE EVALUATION MODEL

Due to above process only investigates and researches on students, it is not so convincingly, the paper also selects teachers to evaluate on it, by above same process calculating, finally it can get its evaluation fuzzy set is :

$P^T = (0.285,\ 0.287,\ 0.237\ ,0.191\ ,0.000)$

$P^L = (0.374,\ 0.376,\ 0.250\ ,0.000\ ,0.000)$

Then combines with above students' comprehensive evaluation, regarding basketball teaching total fuzzy comprehensive evaluation result can form into matrix form:

$$K = \begin{bmatrix} 0.266 & 0.266 & 0.250 & 0.148 & 0.070 \\ 0.285 & 0.287 & 0.237 & 0.191 & 0.000 \\ 0.374 & 0.376 & 0.250 & 0.000 & 0.000 \end{bmatrix}$$

Assume students and teachers' weight set is:

$A = (0.4,\ 0.3,\ 0.3)$

Then, we can solve regarding students and teachers' combined total comprehensive evaluation result is :

$$P' = A' \cdot K = (0.4,\ 0.3,\ 0.3,) \begin{bmatrix} 0.266 & 0.266 & 0.250 & 0.148 & 0.070 \\ 0.285 & 0.287 & 0.237 & 0.191 & 0.000 \\ 0.374 & 0.376 & 0.250 & 0.000 & 0.000 \end{bmatrix} \quad (20)$$

$= (0.300,\ 0.300,\ 0.282,\ 0.190,\ 0.074)$

After normalizing above result, we can get:

$P = (0.271,\ 0.271,\ 0.223,\ 0.171,\ 0.064)$

We can quantize above result in table, as following TABLE 4 show:

Combine with above evaluation criterion, we can quantize above evaluation result in the form of scores, as following TABLE 5 show:

In order to more reasonable evaluate, the paper selects each grade representative value as its research objects, meanwhile it composes of a grade matrix form as:

$G = (94, 84,\ 74,\ 66\ ,56)$

We let basketball teaching comprehensive evaluation computational equation to be:

$H = P \cdot G^T$

Then, input above result into above formula, and it has:

$$H = (0.271, 0.271,\ 0.223\ ,0.171,\ 0.064) \begin{bmatrix} 94 \\ 84 \\ 74 \\ 66 \\ 56 \end{bmatrix} \quad (21)$$

$= 0.271 \times 94 \times 0.271 \times 84 \times 0.223 \times 74 + 0.171 \times 66 \times 0.064 \times 56$

$= 79.61$

TABLE 5 : Teaching quality comprehensive evaluation scores summary sheet

Grade	Excellent	Good	Normal	Poor	Bad
Scores	90□100	80□89	70□79	60□69	50□59
Representative scores	94	84	74	66	56

By above result, we can get if it researches on one teacher, then the teacher basketball teaching comprehensive evaluation result can be judged as 79.61scores, so it shows that the teacher basketball teaching belongs to "normal" or "good" level.

CONCLUSIONS

By applying fuzzy mathematics way, it makes comprehensive evaluation on basketball teaching quality, and combines with cases to analyze and illustrate, the evaluation is kind of relative evaluation result, due to each evaluation indicator weight and weight number are not fixed and unchanged while got by interviewing, so the evaluation way is not a kind of absolute one, final evaluation result is 79.61 scores that indicate basketball educational teaching quality still has great promotion space, universities should particularly focus on teachers' comprehensive levels in future teachers' selection process, so that ensure basketball move to higher level.

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