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Utilize fuzzy mathematics to research on university basketball evaluation mode

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ABSTRACT

University sports education generally adopts final results testing way, but the test way has some drawbacks, therefore the paper takes basketball as research object, researches on university basketball evaluation mode. Due to basketball evaluation mode has fuzziness or uncertainties, research object should consider multiple influence factors, such as theory of study, technology assessment, and basic ability assessment, self evaluation. Therefore the paper makes analysis of university basketball education mode by fuzzy mathematics. Results show: basketball course testing mode needs to consider multiple influence factors as theory of learning, technology assessment, and basic ability assessment, self evaluation. It gets weight results: technology assessment accounts for 40% of evaluation, theory of learning accounts for 30%, basic ability assessment accounts for 25% and self summary accounts for 5%.

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KEYWORDS

Fuzzy mathematics;
Basketball evaluation;
Evaluation model;
Education mode.

INTRODUCTION

Fuzzy mathematics comes from people recognition of external world, due to affected by numerous factors; human race cognitive things are fuzzy. Fuzzy mathematics is a theoretical system that formed by fuzzy set and fuzzy logic, fuzzy mathematics applies into pattern recognition and artificial intelligence; as a relative new discipline, fuzzy mathematics represents some factors set into people's awareness. By establishing property scale on one object, it makes fuzzy mathematical analysis of one object; firstly the object should possess fuzziness or uncertainties, and research object should have multiple influence factors constraints. By fuzzy mathematics, it makes analysis of university basketball education mode.

University sports education generally adopts final results testing way, but it cannot fair and just exhibit students' true level, some students performing is worse during evaluation period, but they show excellent or make efforts to exercise at ordinary times, and some students may show excellent during testing period but they are severe absent and undisciplined at ordinary times, therefore it causes serious unfair phenomenon.

By analyzing questionnaire results, it gets physical education course evaluation contents theoretical performance, technical performance, ordinary times performance, technology assessment have different percentages, as TABLE 1. Therefore, it can explain that university basketball educational course testing contents

TABLE 1: Performance evaluation contents distribution list

Basketball course evaluation content	Percentage frequency distribution							
	0	10%	20%	30%	40%	50%	60%	70%
Theoretical performance	0	0	0	17	3	2	0	0
Technical performance	0	0	0	0	2	14	5	1
Ordinary times performance	0	19	3	0	0	0	0	
Technology assessment	5	14	3	0	0	0	0	0

are not the same. Therefore, research on basketball course evaluation way's analysis has higher requirements.

MODEL ESTABLISHMENTS

General of fuzzy comprehensive evaluation model

Utilize fuzzy comprehensive evaluation, steps are as following:

(1) Establish factor set U ,

$$U = (U_1 \quad U_2 \quad \cdots \quad U_k)$$

(2) Establish judgment set V (evaluation set),

(3) Establish judgment matrix fuzzy mapping from U to, obtained fuzzy relation is as following matrix show,

$$R = \begin{bmatrix} r_{11} & r_{12} & \cdots & r_{1n} \\ r_{21} & r_{22} & \cdots & r_{2n} \\ \vdots & \vdots & & \vdots \\ r_{m1} & r_{m2} & \cdots & r_{mn} \end{bmatrix}$$

(4) Establish weight set, $A = (a_1, a_2, \cdots, a_n)$, it meets condition:

$$\sum_{i=1}^{n} a_i = 1 \quad a_i \geq 0$$

(5) Fuzzy relation R every line reflects the line influence factors to object judgment degree, meanwhile every column reflects the column influence factors to object judgment degree.
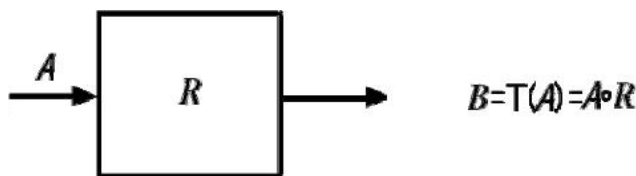

Figure 1: Change model

$$\sum_{i=1}^{n} r_{ij} \quad j = 1, 2, 3, \cdots, m$$

$$B = A \cdot R$$

$$= (a_1, a_2, a_3, \cdots, a_n) \cdot \begin{bmatrix} r_{11} & r_{12} & \cdots & r_{1n} \\ r_{21} & r_{22} & \cdots & r_{2n} \\ \vdots & \vdots & & \vdots \\ r_{m1} & r_{m2} & \cdots & r_{mn} \end{bmatrix}$$

$$= (b_1, b_2, b_3, \cdots, b_n)$$

V 's fuzzy combination is judgment set B . Based on above description, actual change model is as Figure 1:

As Figure 1 show, it gets fuzzy comprehensive evaluation change model, then it can get corresponding each factor grade evaluation transformation function, evaluation factor u1, u2, u3, u4, u5 membership function can be expressed as following:

$$u_{v1}(u_1) = \begin{cases} 0.5(1 + \dfrac{u_i - k_1}{u_i - k_2}), & u_i \geq k_1 \\ 0.5(1 - \dfrac{k_1 - u_i}{k_1 - k_2}), & k_2 \leq u_i < k_1 \\ 0, & u_i < k_2 \end{cases}$$

$$u_{v2}(u_1) = \begin{cases} 0.5(1 - \dfrac{u_i - k_1}{u_i - k_2}), & u_i \geq k_1 \\ 0.5(1 + \dfrac{k_1 - u_i}{k_1 - k_2}), & k_2 \leq u_i < k_1 \\ 0.5(1 - \dfrac{u_i - k_3}{k_2 - k_3}), & k_3 \leq u_i < k_2 \\ 0.5(1 - \dfrac{k_3 - u_i}{k_2 - u_i}), & u_i < k_3 \end{cases}$$

$$u_{v1}(u_1) = \begin{cases} 0, & u_i \geq k_2 \\ 0.5(1 - \dfrac{k_1 - u_i}{k_2 - k_3}), & k_3 \leq u_i < k_2 \\ 0.5(1 + \dfrac{k_3 - u_i}{k_2 - u_i}), & u_i < k_3 \end{cases}$$

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Combine with fuzzy evaluation model to evaluate public service

It gets basketball testing contents evaluation structural graph, Figure 2 shows first grade indicator and second grade indicator.

Establish factor set U, $U = (U_1 \quad U_2 \quad U_3 \quad U_4)$.

Among them, theory of learning U_1, technology assessment U_2, basic ability assessment U_3, self evaluation U_4, and get TABLE 2.

By TABLE 2 listed factors, it gets evaluation set.
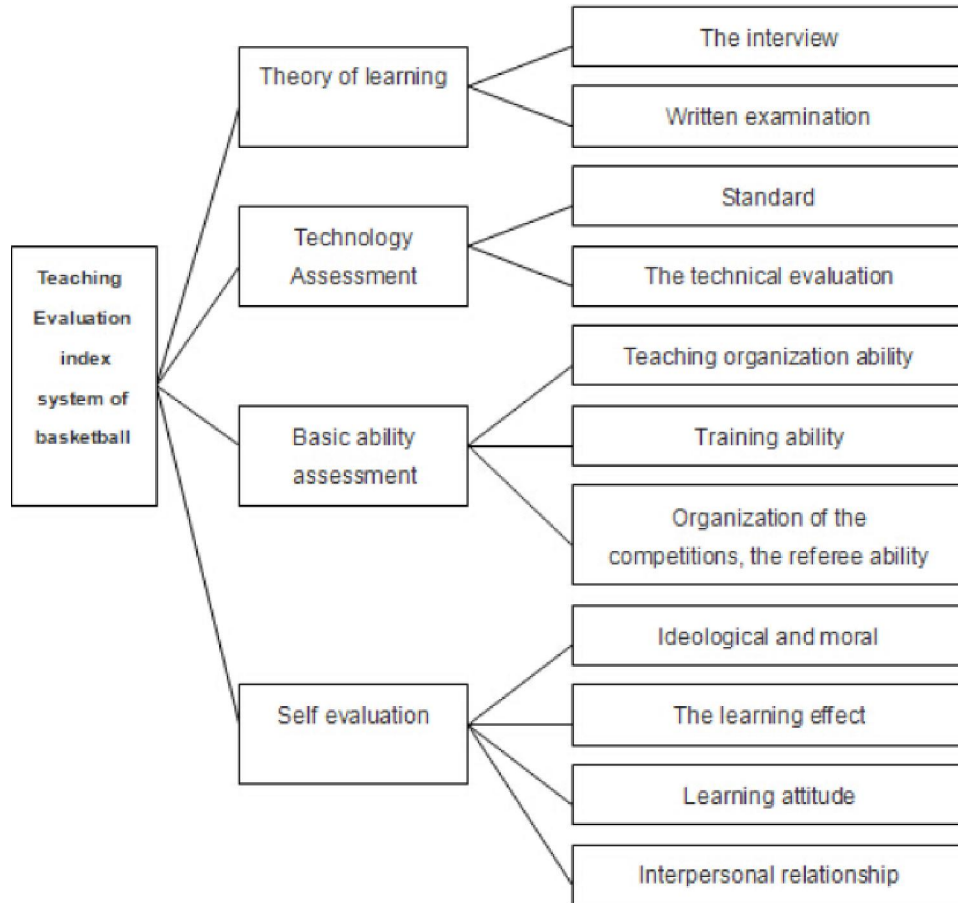
$$U_1 = \{u_{11}, u_{12}\}$$

Figure 2 : Basketball testing contents' evaluation structural graph

$$U_2 = \{u_{21}, u_{22}\}$$

$$U_3 = \{u_{31}, u_{32}, u_{33}\}$$

$$U_4 = \{u_{41}, u_{42}, u_{43}, u_{44}\}$$

By collecting data, analyze and get theory of learning U_1, technology assessment U_2, basic ability assessment U_3, self evaluation U_4 four factors importance degree ranking statistics, as TABLE 3 show.

By TABLE 3 sorting, it gets theory of learning U_1, technology assessment U_2, basic ability assessment U_3,

self evaluation U_4 four aspects ranking matrix.

$$U_2 = \{23, 7, 3, 0\}$$

$$U_2 = \{7, 18, 8 \, 0\}$$

$$U_3 = \{0, 9, 13, 12\}$$

$$U_4 = \{3, 0, 9, 21\}$$

From rank 1 to rank 2, obtained weighting vector

$$\beta = \{\beta_1, \beta_2, \beta_3, \beta_4\} = \{0.4, 0.3, 0.2, 0.1\}$$

$$U_i^* = U_i \cdot \beta^T$$

TABLE 2: Basketball teaching evaluation indicator system

Theory of learning U_1	Technology assessment U_2	Basic ability assessment U_3	Self evaluation U_4
The interview u_{11}	Standard u_{21}	Teaching organization ability u_{31}	Ideological and moral u_{41}
Written examination u_{12}	The technical evaluation u_{22}	Training ability u_{32}	The learning effect u_{42}
		Organization of the competitions, the referee ability u_{33}	Learning attitude u_{43}
			Interpersonal relationship u_{44}

$U_1^* = 12$, $U_2^* = 9.7$, $U_3^* = 6$, $U_4^* = 5$

The paper takes normalization processing

$U_1^* = 0.35$, $U_2^* = 0.3$, $U_3^* = 0.2$, $U_4^* = 0.15$

It gets

$\bar{A} = (0.35 \quad 0.3 \quad 0.2 \quad 0.15)$

The paper gets remark membership by basketball examination performance, as TABLE 4 show.

The paper according to one basketball examination mode each indicator obtained evaluation, it gets TABLE 5.

By above model, it gets single hierarchical indicator weight factor fuzzy set is

$U_1^* = \{U_{11}, U_{12}, U_{13}, U_{14}, U_{15}\} = \{0.25\ 0.25\ 0.2\ 0.15\ 0.15\}$

$U_2^* = \{U_{21}, U_{22}, U_{23}, U_{24}\} = \{0.54\ 0.1\ 0.24\ 0.14\}$

TABLE 3: Four kinds of factors importance degree ranking statistics

Classification	Rank 1	Rank 2	Rank 3	Rank 4
Theory of learning U_1	23	7	3	0
Technology assessment U_2	7	18	8	0
Basic ability assessment U_3	0	9	13	12
Self evaluation U_4	3	0	9	21

$U_3^* = \{U_{31}, U_{32}, U_{33}, U_{34}\} = \{0.4\ 0.3\ 0.1\ 0.2\}$

$U_4^* = \{U_{41}, U_{42}, U_{43}\} = \{0.3\ 0.4\ 0.3\}$

The paper according to TABLE 5, and combines with TABLE 3 remark membership, it gets theory of learning U_1, technology assessment U_2, basic ability assessment U_3, self evaluation U_4 each aspect evaluation set:

Theory of learning $U_1 = \begin{pmatrix} 0 & 0 & 0.05 & 0.95 \\ 0 & 0 & 0.05 & 0.95 \end{pmatrix}$

Technology assessment $U_2 = \begin{pmatrix} 0 & 0 & 0.05 & 0.95 \\ 0 & 0 & 0.05 & 0.95 \end{pmatrix}$

Basic ability assessment $U_3 = \begin{pmatrix} 0 & 0 & 0.05 & 0.95 \\ 0 & 0.05 & 0.9 & 0.05 \\ 0 & 0.05 & 0.9 & 0.05 \end{pmatrix}$

Self evaluation $U_4 = \begin{pmatrix} 0 & 0 & 0.05 & 0.95 \\ 0 & 0.05 & 0.9 & 0.05 \\ 0 & 0.05 & 0.9 & 0.05 \\ 0.05 & 0.9 & 0.05 & 0 \end{pmatrix}$

$B_i = A_i \cdot R_i$

TABLE 4 : Remark membership

Evaluation way	Setting scores intervals			
	0-60	60-80	80-90	90-100
Very well	0	0	0.05	0.95
Good	0	0.05	0.9	0.05
Normal	0.05	0.9	0.05	0
Bad	0.95	0.05	0	0

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TABLE 5 : Basketball examination mode each indicator obtained evaluation value

Each layer indicator	Evaluation value	Each layer indicator	Evaluation value
The interview u_{11}	Very well	Ideological and moral u_{41}	Very well
Written examination u_{12}	Very well	The learning effect u_{42}	Good
Standard u_{21}	Normal	Learning attitude u_{43}	Good
The technical evaluation u_{22}	Normal	Interpersonal relationship u_{44}	Normal
Teaching organization ability u_{31}	Normal		
Training ability u_{32}	Very well		
Organization of the competitions, the referee ability u_{33}	Very well		

Do normalization processing with solved B_i, it gets fuzzy evaluation matrix.

$$\bar{B} = \begin{pmatrix} B_1 \\ B_2 \\ B_3 \\ B_4 \end{pmatrix} = \begin{pmatrix} 0.07 & 0.27 & 0.13 & 0.53 \\ 0 & 0.1 & 0.4 & 0.5 \\ 0.08 & 0.46 & 0.38 & 0.08 \\ 0.14 & 0.2 & 0.3 & 0.36 \end{pmatrix}$$

It gets comprehensive evaluation value

$$Z = U^* \cdot B$$
$$= \begin{pmatrix} 0.3 & 0.4 & 0.25 & 0.05 \end{pmatrix}$$

CONCLUSIONS

Fuzzy mathematics development up to now, it has 40 years history, though it is a relative new discipline, it has extremely plentiful contents in theory, and fuzzy mathematics involves natural science, social science and other disciplines. Evaluation is a kind of human thinking process; it is not changing in linear. Based on fuzzy mathematics features, the paper analyzes university basketball education mode by fuzzy mathematics. To basketball course testing mode, it should consider multiple influence factors, as theory of learning, technology assessment, and basic ability assessment, self evaluation.

It gets weight results: $Z = \begin{pmatrix} 0.3 & 0.4 & 0.25 & 0.05 \end{pmatrix}$, it shows in uni-

versity basketball sports evaluation mode, technology assessment accounts for 40% of evaluation, theory of learning accounts for 30%, basic ability assessment accounts for 25% and self summary accounts for 5%.

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