Analytic hierarchy process-based basketball education mode to talents cultivation impacts exploration

Cheng Yang¹, Xiaolin Zhang²*, Haifei Wang¹
¹Institute of Physical Education, Southwest Petroleum University, Chengdu 610500, Sichuan, (CHINA)
²Institute of Physical Education, Chengdu University of Technology, Chengdu 610059, Sichuan, (CHINA)

ABSTRACT

For basketball education mode problems, the paper establishes a clear and well-organized structure, firstly it constructs three layers relations, target layer, medium layer, scheme layer, and classified layers numbers are related to research objects complicated degree and detailed degree. It mainly targeted basketball education mode each kind of education way proportion, uses analytic hierarchy process to make qualitative analysis and quantitative analysis, takes physical quality, spirit of cooperation, sense of competition and anti frustration ability four aspects as criterion targets. It gets basketball education mode education proportion in cooperative education, physical education as well as entertainment and humanistic education such three aspects. By solving judgment matrix maximum feature value and feature vector, it gets weights. The paper gets that in basketball education mode, physical education is particularly important to basketball that occupied proportion is 40.2%, and basketball is a kind of team exercise, therefore, in basketball education mode, followed by students cooperative ability training that occupies 32.5% of totals. Thirdly, to students in school or contemporary university students, humanistic education and entertainment education are effective ways to easy students' life and relieve learning pressure, therefore in education mode, it occupies 28.3%.

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KEYWORDS

Basketball;
Education mode;
Analytic hierarchy process;
Judgment matrix;
Talents cultivation.

INTRODUCTION

Analytic hierarchy process is originated from 1970s that discovered by an American operational research expert, he classified objects relative factors into target layer, criterion layer, scheme layer, and formed into good qualitative and quantitative analysis.

In recent years, domestic researches on basketball are fewer, and research orientations more concentrate on basketball status analysis, basketball training mode, basketball humanistic analysis and so on. Though competitive basketball appeared systematic researches, it lacked of meticulous researches, and lacked of cogent strategy. The paper combines with analytic hierarchy process to make research on Chinese basketball education mode.

MODEL ESTABLISHMENTS

Establish hierarchical structure

Firstly establish a clear and well-organized structure for problems, at first establish three layer relations, target layer, medium layer, scheme layer. Classified layer number is related to research objects' complicated degree and detailed degree.

The paper based on analytic hierarchy process, it quantizes basketball. Establish target layer, criterion layer, scheme layer relations.

Target layer: Basketball education mode.

Criterion layer: scheme's influence factors, c_1 is the physical quality, c_2 is spirit of cooperation, c_3 is sense of competition, c_4 is anti frustration ability.

Scheme layer: A_1 is cooperative education, A_2 is physical education, A_3 is entertainment and humanistic education, it gets hierarchical structure.

Construct each layer judgment matrix

In criterion layer, each criterion target occupies different proportions, by researchers researching on criterion layer, and according to number 1~9 and its reciprocal to judge each criterion target occupied weights. The paper takes TABLE 1 showed 1~9 scale table as evidence, it makes weight analysis.

TABLE 1: 1~9 scale table

Scale a_{ij}	Definition
1	factor i and factor j have equal importance
3	factor i is slightly more important than factor j
5	factor i is relative more important than factor j
7	factor i is extremely more important than factor j
9	factor i is absolute more important than factor j
2 4 6 8	Indicates middle state corresponding scale value of above judgments
Reciprocal	If factor i and factor j are relative weak, obtained judgment is reciprocal

At first, solve judgment matrix, according to above principle, reference 1-9 scale setting, and according to experts' experiences and refer to lots of documents, it gets paired comparison matrix that are respective as TABLE 2-6.

Among them, TABLE 2 is target layer and criterion layer comparison matrix, TABLE 3-6 are criterion layer and scheme layers' comparison matrixes.

TABLE 2 : Comparison matrix

G	c_1	c_2	c_3	c_4
c_1	1	1/3	3	3
c_2	31/8	1	5	5
c_3	1/3	1/5	1	1
c_4	1/3	1/5	1	1

TABLE 3 : Comparison matrix

c_1	A_1	A_2	A_3
A_1	1	1	1/3
A_2	1	1	1/3
A_3	3	3	1

TABLE 4 : Comparison matrix

c_2	A_1	A_2	A_3
A_1	1	8	7
A_2	1/8	1	5
A_3	1/7	1/5	1

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TABLE 5 : Comparison matrix

c_3	A_1	A_2	A_3
A_1	1	5	8
A_2	1/5	1	5
A_3	1/8	1/5	1

TABLE 6: Comparison matrix

c_4	A_1	A_2	A_3
A_1	1	3	8
A_2	1/3	1	5
A_3	1/8	1/5	1

Hierarchical single arrangement and consistency test

Use consistency indicator to test:

Set in comparison matrix, $\lambda_{\max}$ is maximum feature value, n is comparison matrix order.: $CI = \frac{\lambda_{\max} - n}{n-1}$, CI Value gets smaller; Judgment matrix gets closer to completely consistent. CI gets bigger shows that known degree is lower.

Hierarchy total sorting and its consistency test

$$A = \begin{Bmatrix} 1 & 1/3 & 3 & 3 \\ 3 & 1 & 5 & 5 \\ 1/3 & 1/5 & 1 & 1 \\ 1/3 & 1/5 & 1 & 1 \end{Bmatrix}$$

$$\xrightarrow{\text{Column vector normalization}} \begin{Bmatrix} 0.214 & 0.192 & 0.3 & 0.3 \\ 0.075 & 0.577 & 0.5 & 0.5 \\ 0.121 & 0.115 & 0.1 & 0.1 \\ 0.201 & 0.115 & 0.1 & 0.1 \end{Bmatrix}$$

$$\xrightarrow{\text{Solve sum by line}} \begin{Bmatrix} 1.066 \\ 2.22 \\ 0.386 \\ 0.386 \end{Bmatrix}$$

$$\xrightarrow{\text{Normalization}} \begin{Bmatrix} 0.2515 \\ 0.555 \\ 0.0965 \\ 0.0965 \end{Bmatrix} = W^{(0)}$$

It can get:

$$AW^{(0)} = \begin{Bmatrix} 1 & 1/3 & 3 & 3 \\ 3 & 1 & 5 & 5 \\ 1/3 & 1/5 & 1 & 1 \\ 1/3 & 1/5 & 1 & 1 \end{Bmatrix} \begin{Bmatrix} 0.2514 \\ 0.555 \\ 0.0965 \\ 0.0965 \end{Bmatrix} = \begin{Bmatrix} 1.012 \\ 2.275 \\ 0.387 \\ 0.387 \end{Bmatrix}$$

$$\lambda_{\max}^{(0)} = \frac{1}{4}\left(\frac{1.054}{0.257} + \frac{2.254}{0.786} + \frac{0.257}{0.045} + \frac{0.457}{0.078} \right) = 4.038$$

$$w^{(0)} = \begin{pmatrix} 0.278 \\ 0.56 \\ 0.045 \\ 0.098 \end{pmatrix}$$

(1) Similarly, it can calculate judgment matrix

$$B_1 = \begin{Bmatrix} 1 & 1 & 1/3 \\ 2 & 1 & 1/3 \\ 3 & 6 & 1 \end{Bmatrix}, B_2 = \begin{Bmatrix} 1 & 5 & 5 \\ 1/5 & 1 & 2 \\ 1/5 & 1/5 & 1 \end{Bmatrix}, B_3 = \begin{Bmatrix} 1 & 6 & 8 \\ 1/5 & 1 & 5 \\ 1/8 & 1/5 & 1 \end{Bmatrix}, B_4 = \begin{Bmatrix} 1 & 8 & 8 \\ 1/5 & 1 & 5 \\ 1/8 & 1/5 & 1 \end{Bmatrix}$$

By above, it is clear that the paper takes solved maximum feature value and feature vector as weights to analyze, and establishes weight hierarchical Figure 1.

$$\lambda^{(1)}_{\max} = 3.31, \omega^{(1)}_1 = \begin{Bmatrix} 0.252 \\ 0.089 \\ 0.66 \end{Bmatrix}$$

$$\lambda^{(2)}_{\max} = 3.12, \omega^{(1)}_2 = \begin{Bmatrix} 0.575 \\ 0.286 \\ 0.139 \end{Bmatrix}$$

$$\lambda^{(3)}_{\max} = 3.30, \omega^{(1)}_3 = \begin{Bmatrix} 0.624 \\ 0.240 \\ 0.136 \end{Bmatrix}$$

$$\lambda^{(4)}_{\max} = 4.05, \omega^{(1)}_4 = \begin{Bmatrix} 0.185 \\ 0.240 \\ 0.575 \end{Bmatrix}$$

Use TABLE 7 RI value to test consistency indicator: $CI = \frac{\lambda_{\max} - n}{n-1}$, $CR = \frac{CI}{RI}$

By calculating, it gets judgment matrix A, $\lambda^{(0)}_{\max} = 4.073, RI = 0.9$

$$CI = \frac{4.073 - 4}{4-1} = 0.24$$

$$CR = \frac{CI}{RI} = \frac{0.024}{0.90} = 0.027 < 0.1$$

It shows A inconsistency test is valid and within permissible range, it can use A feature vector to replace weight vector.

TABLE 7 : RI value

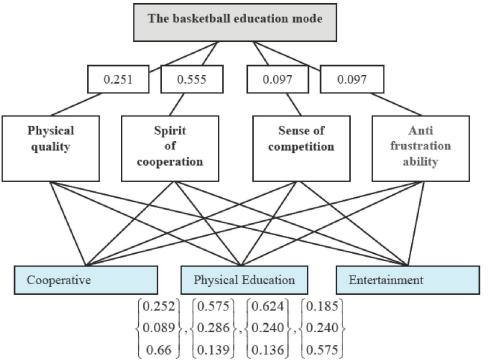| n	1	2	3	4	5	6	7	8	9	10	11
RI	0	0	0.58	0.90	1.12	1.24	1.32	1.41	1.45	1.49	1.51

Figure 1 : Hierarchical chart

(2) Similarly, make consistency test on judgment matrix B_1, B_2, B_3, B_4, it gets weight vectors. Utilize hierarchical chart drawing out calculation results from target layer to scheme layer, as Figure 1 show. Calculation structure as following:

$$\omega^{(1)} = (\omega_1^{(1)}, \omega_2^{(1)}, \omega_3^{(1)}, \omega_3^{(1)})$$

$$= \begin{Bmatrix} 0.624 & 0.185 & 0.252 & 0.575 \\ 0.234 & 0.240 & 0.089 & 0.286 \\ 0.136 & 0.575 & 0.66 & 0.139 \end{Bmatrix}$$

$$w = w^{(1)} w^{(0)}$$

$$= \begin{Bmatrix} 0.262 & 0.585 & 0.664 & 0.185 \\ 0.079 & 0.276 & 0.220 & 0.240 \\ 0.66 & 0.149 & 0.156 & 0.575 \end{Bmatrix} \begin{Bmatrix} 0.567 \\ 0.056 \\ 0.104 \\ 0.273 \end{Bmatrix}$$

$$= \begin{Bmatrix} 0.325 \\ 0.402 \\ 0.283 \end{Bmatrix}$$

It gets conclusions: in basketball education mode, physical education is particularly important to basketball that occupied proportion is 40.2%, and basketball is a kind of team exercise, therefore, in basketball education mode, followed by students cooperative ability training that occupies 32.5% of totals. Thirdly, to students in school or contemporary university students, humanistic education and entertainment education are effective ways to easy students' life and relieve learning pressure, therefore in education mode, it occupies 28.3%.

CONCLUSION

Analytic hierarchy process can dynamic integrate qualitative analysis with quantitative analysis to make multiple targets decision-making analysis, the method can analyze a problem according to its contained all kinds of factors occupied weights, and classifies a problem into different hierarchies and multiple, comprehensive influence factors, by paired factors comparing, it gets comparison matrix. And there are many analytic hierarchy process methods, as fuzzy analytic hierarchy process, grey analytic hierarchy process, improved analytic hierarchy process and so on.

For basketball education mode problems, it mainly

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targeted basketball education mode each kind of education way proportion, uses analytic hierarchy process to make qualitative analysis and quantitative analysis, takes physical quality, spirit of cooperation, sense of competition and anti frustration ability four aspects as criterion targets. It gets basketball education mode education proportion in cooperative education, physical education as well as entertainment and humanistic education such three aspects. By solving judgment matrix maximum feature value and feature vector, it gets weights, and gets conclusion that in basketball education mode, physical education is particularly important to basketball that occupied proportion is 40.2%, cooperative ability training occupies 32.5% of totals, humanistic education and entertainment education occupies 28.3% of education mode.

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