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Analytic hierarchy process-based college football teaching mode research

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ABSTRACT

Football is a kind of ancient sports event with a long history. It was originated from Chinese ancient times one kind of ball game "Chuk-guk", later was introduced to Europe by Arabian, and then developed into modern football. Therefore, football's hometown is China. The paper bases on analytic hierarchy process, establishes college football teaching mode's AHP model, by comparing weights, it gets most suitable Chinese college football teaching mode. Old-fashioned teaching ideas, football fields, training equipment, curriculum learning time and other factors have certain influences on football teaching mode. By far, colleges applied teaching modes are mainly experience type teaching mode, race type teaching mode, on this basis, utilize analytic hierarchy process to establish target layer, scheme layer and criterion layer. By calculating and analyzing, it is clear that experience type teaching mode weight is the maximum one, secondly is race type teaching mode, traditional teaching. Therefore, it gets conclusion: experience type teaching mode is most suitable teaching mode of college football.

KEYWORDS

College football; Teaching mode; Analytic hierarchy process; Diversification; School physical education.



INTRODUCTION

Football is a kind of comprehensive event, it has its unique charms, therefore it attracts numerous football enthusiasts to positive participate in football exercise. Similarly, colleges broad students have also successively joined in football exercises, bring football into colleges courses is taken for granted. Due to affected by teachers' single knowledge structure, single teaching level, old-fashioned methods, football fields, training equipment, curriculum learning time and other factors, colleges football teaching mode research has become one of problems to be considered at present.

By looking through lots of this kind of literatures, it finds that numerous scholars have studied colleges' football teaching mode. Li Chun-Sheng in the article "Briefly discussion on colleges' football teaching reformation and countermeasures under new situations" carried out comprehensive studies and analysis of colleges' football teaching, by investigation, he found that Chinese colleges' football teaching had shortcomings and drawbacks, and accordingly put forward corresponding solutions, and propelled to Chinese colleges football teaching development.

Wang Yuan-Bing in "Humble opinions on building colleges football effective class", he pointed out effective class's importance to teaching, and by learning sports new curriculum reformation spirits as well as combining with colleges football teaching years' practical experiences, he stated some opinions on building colleges football effective class.

Dai Zheng-Jun, Gai An-Jun in "Briefly analyze Jiangxi teenager football status and reserve talents cultivation", according to Jiangxi province present teenager football status and existing problems, by consulting lots of literatures, questionnaire survey, interview and other methods, they pointed out that the key to revitalize Jiangxi province football was talents cultivation, especially for broadly teenagers reserve talents cultivation, therefore it should focus on teenager football teaching, strengthen "combination of sports and education" mode and create good football teaching environment.

The paper comprehensive analyzes colleges football teaching modes status, references relative literatures and numerous scholars summarized experiences, starts from diversity perspective, analyzes colleges football old-fashioned teaching ideas, fields, training equipment, curriculum learning time and other factors, utilizes mathematical methods, establishes colleges football teaching mode influential analytic hierarchy process model, and then gets most suitable teaching mode of Chinese college football.

RECENT YEARS' CHINESE COLLEGES' FOOTBALL TEACHING MODE STATUS

Below TABLE 1, TABLE 2 are respectively Chinese colleges students' each sports teaching event interest extent status table, Chinese colleges' football course attendance attitudes status table. Data is from China's statistics office statistical yearbook.

TABLE 1 : Chinese colleges students interested sports teaching events (N=863)

Event	Schoolboy (%)	Schoolgirl (%)	Total (%)		
Basketball	102	22.9	25	6	14.7
Table tennis	89	20	40	9.6	14.9
Volleyball	40	8.9	56	13.4	11.1
Football	45	10.1	12	2.7	6.6
Badminton	74	16.1	79	18.9	17.7
Aerobics	28	6.2	90	21.5	13.7
Running	20	4.4	58	13.9	9
Martial arts	32	7.2	30	7.2	7.2
Else	15	3.3	28	6.7	5

In order to easily observe colleges students interest extents on each sports teaching event, draw above data into bar Figure 1 as following:

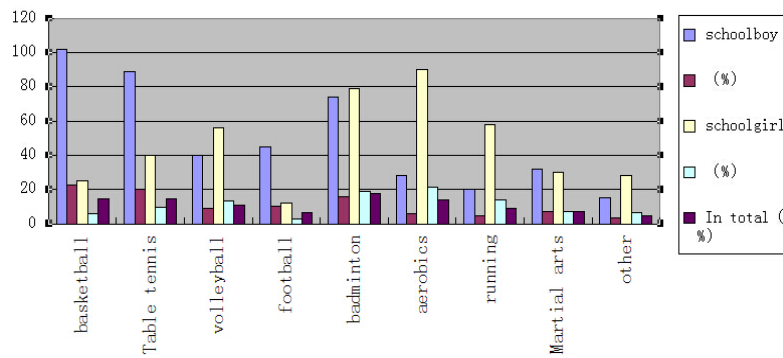


Figure 1 : China's colleges and colleges students interested in sports teaching project (N = 863)

In order to more intuitional, more clearly observe colleges students football course attendance attitude, draw TABLE 2 data into broken line Figure 2 as following:



Figure 2 : Our country colleges' student football lessons

TABLE 2: Chinese colleges students football course attendance attitudes (N=863)

Gender	Very like	Like	Dislike	Not to matter
Schoolboy (%)	25.9	56.6	4.6	12.9
Schoolgirl (%)	30.2	48.2	2.9	18.7
Total (%)	26.4	54.5	3.2	15.9

From above Figure 2and TABLE 2, it is clear that Chinese vocational college students fondness extent on football is far less than basketball, volleyball, aerobics and so on, football fondness extent only occuppies 6.6%, while table tennis occuppies 14.9%, basketball occuppies 14.7%. However, schoolboys and schoolgirls interests and hobbies on sports teaching events are also different, for schoolgirls, they are more inclined to participate in interesting sports events as aerobics, badminton and so on, while relatively for schoolboys, they are more inclined to larger activities levels' sports events as basketball, table tennis and so on. For attitudes towards football course attendance, schoolboys that like to attend football course occupy 82.5%, and schoolgirls occupy 78.4%, therefore it is clear that schoolboys prefer to attend football course with respect to schoolgirls. Therefore, in order to let more students to love football and participate in football, find out most suitable Chinese colleges football teaching mode is one of important problems that we confront at present.

COLLEGES FOOTBALL TEACHING MODE INFLUENTIAL ANALYTIC HIERARCHY PROCESS MODEL

Football teaching mode suffers multiple factors influences, such as old-fashioned teaching ideas, football fields, training equipment, curriculum learning time and so on. The paper establishes analytic hierarchy process model, makes quantization on football teaching mode orientations, by establishing target layer, criterion layer and scheme layer relations, finally it gets most suitable Chinese colleges football teaching mode in future.

Model establishment

AHP is based on posed problems' requirements and properties, it makes classification on its included factors, generally divides them into target layer, criterion layer and scheme layer, so that constitutes a hierarchical shape structure, and makes paired mutual comparison of each factor in the same layer, and defines next layer weight with respect to previous layer target. By analyzing every layer, finally rank target layer, criterion layer and scheme layer each factor that the factor importance degree to total target. Its main features are reasonable combining qualitative and quantitative decisions so that let decision process to be layering and quantified.

Target layer: College football teaching mode

Criterion layer: Scheme influence factors, C_1 is old-fashioned teaching ideas, C_2 is football field, C_3 is training equipment, C_4 is course of time.

Scheme layer: A_1 is experience type teaching mode, A_2 is traditional teaching, A_3 is race type teaching mode

By analyzing college football teaching mode problem, layer relative influence factors from top to down, last layer suffers next layer influences, but each layer factors are relative independent. Then it gets following hierarchical structure Figure 3:

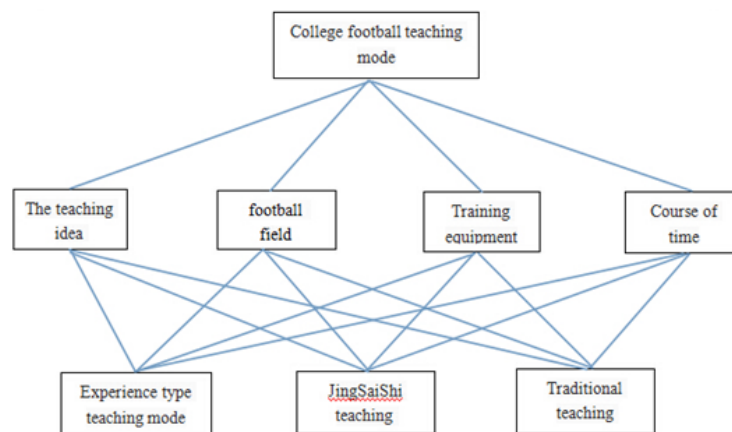


Figure 3 : The hierarchical structure

Factor analysis

1) Old-fashioned teaching ideas

With rapidly development of information era, teaching system reformation appealing are constantly increasing in each grade each kind of colleges, but in view of present status, many vocational colleges' sports teachers cannot well adapt to sports teaching reformation in new situations, they cannot catch up with pace of the times, and still in the old-fashioned teaching ideas, which generates unquestionable impacts on football teaching mode.

2) Football field

In recent years, vocational colleges have constantly expanded enrollment so that colleges' sports fields cannot meet sports teaching and students' sports activities. According to investigation indication, Chinese colleges averagely have 2 football fields, students attendance numbers have already arrived at several hundred, which causes football fields being in short supply, and then affects football teaching modes and learning efficiency.

3) Training equipment

Sound training equipment is material guarantee to improve football teaching. By far, colleges training equipments are very simple and crude, which leads to teachers cannot well pass on more movement techniques to students, and students also cannot fully understand essentials and apply them into training.

4) Course of time

Comrade Deng Xiao-Ping had said that football techniques learning is a long term and systematic process. It generates certain limitations on football teaching. By far, Chinese colleges physical education course are averagely 25 class hours, 13 lessons. But it hasn't deducted the influences of raining days, snow days, holidays and other factors; therefore football course learning time is far from enough. And then it has great impacts on football teaching mode.

Construct paired comparison matrix

Construct paired comparison matrix is carrying on paired comparison among elements, using matrix to express each layer every element importance to previous layer all elements, here apply operational research expert proposed 1~9 ratio scale, as TABLE 3.

TABLE 3 : 1~9 scale definition

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 of above each value	If compare indicator i with indicator j , the relative importance use above one numeric value scale, then indicator j and indicator i relative importance use above numeric value reciprocal scale

According to above scale TABLE 3, set judgment matrix A as:

$$A = \begin{pmatrix} 1 & 4 & 4 & 4 \\ \frac{1}{4} & 1 & 3 & 3 \\ \frac{1}{4} & \frac{1}{3} & 1 & 1 \\ \frac{1}{4} & \frac{1}{3} & 1 & 1 \end{pmatrix}$$

Obviously, A is positive reciprocal matrix.

Calculate compared element relative weight on the criterion

Consistency matrix definitions and property:

Consistency matrix's definition : Positive reciprocal matrix that meets $a_{ij} * a_{jk} = a_{ik}, i, j = 1, 2, \dots, n$ is consistency matrix. For example :

$$A = \begin{pmatrix} \frac{w_1}{w_1} & \frac{w_1}{w_2} & \dots & \frac{w_1}{w_n} \\ \frac{w_2}{w_1} & \frac{w_2}{w_2} & \dots & \frac{w_2}{w_n} \\ \vdots & \vdots & \ddots & \vdots \\ \frac{w_n}{w_1} & \frac{w_n}{w_2} & \dots & \frac{w_n}{w_n} \end{pmatrix}$$

Consistency matrix property: matrix A order is n, A unique non-zero feature root is n. Matrix A any one column vector is a feature vector that corresponds to n. Matrix A normalized feature vector can be used as weight vector.

However, in above constructed comparison matrix $A = \begin{pmatrix} 1 & 4 & 4 & 4 \\ \frac{1}{4} & 1 & 3 & 3 \\ \frac{1}{4} & \frac{1}{3} & 1 & 1 \\ \frac{1}{4} & \frac{1}{3} & 1 & 1 \end{pmatrix}$,

Because $a_{12} = \frac{C_1}{C_2} = 4$, $a_{13} = \frac{C_1}{C_3} = 4$, it can get $a_{23} = \frac{C_2}{C_3} = 1$, while actually $a_{23} = 3$. So A is not

consistency matrix. In general, for inconsistent (but in permissible range) paired comparison matrix A, it suggests to use feature vector that corresponds to maximum feature root λ as weight vector.

Consistency test:

Consistency indicator: $CI = \frac{\lambda_{max} - n}{n - 1}$. Among them, λ_{max} is maximum feature value of

comparison matrix, n is order of comparison matrix. When n order positive reciprocal matrix maximum feature root λ ≥ n, and λ = n, it is consistency matrix. CI Value gets smaller; judgment gets closer to fully consistent. On the contrary, judgment matrix consistency deflection degree will be bigger.

Random consistency indicator: Randomly generate multiple matrixes, add every matrix consistency indicator and then take average value, it gets RI TABLE 4.

TABLE 4 : Random consistency indicator

n	1	2	3	4	5	6	7	8	9	10	11
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Consistency ratio: If $CR = \frac{CI}{RI} < 0.1$, constructed paired comparison matrix A passes consistency test.

By calculation, it can get paired comparison matrix A maximum feature value λ_{max} = 4.234, RI = 0.86

By consistency indicator $CI = \frac{\lambda_{max} - n}{n - 1}$, input data, it can calculate and get $CI = \frac{4.234 - 4}{4 - 1} = 0.078$

And by consistency ratio $CR = \frac{CI}{RI} = \frac{0.078}{0.86} = 0.091 < 0.1$, so constructed paired comparison matrix A passes consistency test.

Constructed scheme layer judgment matrixes correspond to different criterion layers are as TABLE 5-8.

TABLE 5 : Criterion layer judgment matrix B_1

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 6: Criterion layer judgment matrix B_2

c_2	A_1	A_2	A_3
A_1	1	5	5
A_2	1/5	1	5
A_3	1/5	1/5	1

TABLE 7: Criterion layer judgment matrix B_3

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 8 : Criterion layer judgment matrix B_4

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

Calculate weight vector, to $A = \begin{pmatrix} 1 & 4 & 4 & 4 \\ \frac{1}{4} & 1 & 3 & 3 \\ \frac{1}{4} & \frac{1}{3} & 1 & 1 \\ \frac{1}{4} & \frac{1}{3} & 1 & 1 \end{pmatrix}$, firstly handling as following:

$$\begin{array}{l}
 \xrightarrow{\text{Column vector normalization}} \begin{pmatrix} 0.834 & 0.965 & 0.512 & 0.512 \\ 0.278 & 0.315 & 0.83 & 0.83 \\ 0.278 & 0.061 & 0.157 & 0.157 \\ 0.278 & 0.061 & 0.157 & 0.157 \end{pmatrix} \\
 \xrightarrow{\text{According to the row sum}} \begin{pmatrix} 2.799 \\ 2.259 \\ 0.681 \\ 0.682 \end{pmatrix} \xrightarrow{\text{The normalized}} \begin{pmatrix} 0.719 \\ 0.565 \\ 0.169 \\ 0.169 \end{pmatrix} = W^0
 \end{array}$$

And then, by $A \times W^0$ it further solves $\lambda_{\max}^0 = 4.234$.

Similarly, it can solve criterion layer judgment matrix maximum feature value and weight as following:

$$\begin{aligned}
 \lambda_{\max}^1 = 3.63, W_1 &= \begin{pmatrix} 0.234 \\ 0.234 \\ 0.532 \end{pmatrix}; \lambda_{\max}^2 = 3.30, W_2 = \begin{pmatrix} 0.647 \\ 0.261 \\ 0.090 \end{pmatrix}; \lambda_{\max}^3 = 3.30, W_3 = \begin{pmatrix} 0.649 \\ 0.214 \\ 0.149 \end{pmatrix}; \\
 \lambda_{\max}^4 = 3.30, W_4 &= \begin{pmatrix} 0.649 \\ 0.214 \\ 0.149 \end{pmatrix}
 \end{aligned}$$

And utilize above principle to judge, it is clear that all passes consistency test.

Calculate combination weight vector

$$\text{By } W^1 = (W_1, W_2, W_3, W_4), \text{ and } W = W^1 \times W^0 \text{ it can calculate and get } W = \begin{pmatrix} 0.499 \\ 0.159 \\ 0.327 \end{pmatrix}.$$

By above combination weight calculation result, it can analyze that experience type teaching mode occupies 49.9%, traditional teaching occupies 15.9%, race type teaching mode occupies 32.7%. It further can get conclusion that experience type teaching mode most fits for Chinese colleges football teaching.

CONCLUSION

By analyzing recent years' Chinese colleges' football teaching mode status, the paper learns that vocational colleges many students interests extents on football sports teaching are not so high, therefore find out most suitable Chinese football teaching mode is one of important problems in present development of football sports.

The paper selects colleges football teaching mode as research objects, and meanwhile analyzes football teaching mode influence factors, utilizes analytic hierarchy process, establishes AHP model, and then gets conclusion, experience type teaching mode is most suitable teaching mode of present Chinese colleges' football, and meanwhile we should also encourage race type teaching mode's application.

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