ISSN : 0974 - 7435 Volume 10 Issue 11

2014

BioTechnology

An Indian Journal

FULL PAPER

BTAIJ, 10(11), 2014 [5040-5049]

# Fuzzy AHP method-based Chinese three big balls reserve talents cultivation path optimization research

**Senzhao Lu, Changliang Du**

**Physical Education Department, Nanjing University of Aeronautics and Astronautics, Nanjing210016, (CHINA)**

## ABSTRACT

In current stage, Chinese three big balls development trend is not going well, overall shows collective slump trend. And as three big balls development reserve force, three big balls reserve talents cultivation is the key to their development. The paper firstly states China's shortcomings in three big balls reserve talents cultivation process, and analyzes general cultivation mode and situational teaching cultivation mode two main cultivation schemes specific definitions. On this basis, utilize fuzzy comprehensive evaluation method and analytic hierarchy process method, carry on study on Chinese three big balls reserve talents cultivation path, establish comprehensive evaluation method-based three big balls reserve talents cultivation path model, analyze basic group training, the general theory of culture, team training, race against the type of culture, Context into cultivation, practical training these six kinds of cultivation mode evaluation weights. Finally it gets Context into cultivation is most suitable Chinese three big balls reserve talents cultivation mode, its evaluation weight is the highest.

## KEYWORDS

Chinese three big balls; Reserve talents cultivation; Fuzzy comprehensive evaluation method; Analytic hierarchy process; Path optimization.

## INTRODUCTION

At present, Chinese three big balls reserve talents have disadvantages as insufficient theoretical knowledge, low psychological quality, lack of competition experiences, these are main factors that restrict Chinese three big balls development, and meanwhile are also key factors. Though Chinese three big balls development history is not going well, scholars always work on their researches, they try to find out innovation paths to promote Chinese three big balls development, from which more research results point out orientations for Chinese three big balls development.

Wu Jin-Yuan and others in the article "Chinese 'three big balls' sliding and reserve talents cultivation" took three big balls development as research foundation, analyzed reserve talents important roles in their development process. The paper applied system analysis method, documents literature and others, handled with data and analyzed, and then finally got conclusion: Chinese three big balls development process was relative rough, overall showed slump trend, so as to change Chinese three big balls unoptimistic development phenomenon, reserve talents cultivation was their main development strength. Therefore, it should perfect reserve talents cultivation system, improve reserve talents professional levels, encourage more teenagers to participate in three big balls exercises.

Pang Jian-Min in the article " Chinese basketball, volleyball, football excellent sports team athletes numbers dynamic development changes analysis and comparative study", took Chinese three big balls excellent sports teams athletes numbers dynamic development changes as main research perspective, by analyzing their number of people's changes, predicted future Chinese three big balls development. The paper referenced formers lots of research results, and by spot investigation, it got individual sports institution excellent athletes correlation information, made data analysis, and finally got conclusion: Chinese three big balls excellent athletes number development changes were slower, especially for basketball and football, their slump trends were more serious with respect to volleyball, which had great relations with recent years' Chinese basketball, football performances.

Gao Song-Shan in the article "Henan province competitive sorts status and reserve talents counter measurement research", took Henan province as an example, studied current stage Henan province competitive sports development status, and further studied reserve talents cultivation. The paper pointed out: Henan province competitive sports development with respect to China other main cities, its development speed was slower, reserve talents overall quality was also inferior to other provinces and cities. Therefore, in reserve talents cultivation, it should focus on reserve talents professional basic knowledge grasping, perfect reserve talents management mechanism, and then provide excellent athletes for national sports.

The paper on the basis of formers research results, based on Chinese three big balls reserve talents cultivation status, utilizes mathematical methods to make quantitative analysis, puts forward Chinese three big balls reserve talents cultivation innovation path to provide theoretical basis for three big balls reserve talents cultivation.

## FUZZY COMPREHENSIVE EVALUATION METHOD-BASED THREE BIG BALLS RESERVE TALENTS CULTIVATION MODEL ESTABLISHMENT

As a major sports country, Chinese "three big balls" development is one of key factors to restrict Chinese sports to impact on world sports powers. No doubt, Chinese "three big balls" that is football, basketball and volleyball. Development factors that affect Chinese "three big balls" are various, economic factor, field investment construction, humanistic cultural factor, competition system, reserve talents cultivation, referees and coaches qualities factors and so on.

In three big balls development influential numerous factors, reserve talents cultivation is the key to it. In general, reserve talents cultivation has general cultivation mode and situational teaching cultivation mode. Among them, general cultivation mode contains basic group training、the general

theory of culture, situational teaching cultivation mode contains team training, race against the type of culture, Context into cultivation, and practical training.

For Chinese three big balls reserve talents cultivation path, it mainly has general cultivation mode and situational teaching cultivation mode, from which every cultivation mode specific illustration is as following :

Basic group training refers to group according to sports athletes different foundations, plan different cultivation contents for every group;

The general theory of culture refers to firstly pass on sports athletes basic sports theoretical knowledge, and then carry on specialized practical teaching;

Team training refers to distribute set task to sports athletes, let athletes to fulfill tasks in the form of teamwork, carry on supervising learning in team;

Race against the type of culture refers to arouse sports athletes learning enthusiasm by organizing race, and then promote sports athletes competitiveness, find shortcomings in race;

Context into cultivation refers to set certain situations on cultivation tasks, let sports athletes to experience and understanding teaching in realistic situation.

Practical training refers to pass on theoretical knowledge to sports athletes by practical ways.

On this basis, carry on evaluation analysis on them and further define most suitable Chinese three big balls reserve talents cultivation path to make contributions for Chinese three big balls development.

**Define evaluation indicator set**

According to :

$$U = \{u_1, u_2, \cdots, u_m\}, m = 1,2,3,\cdots,6$$

Evaluation indicator set is={ basic group training、the general theory of culture, team training, race against the type of culture, Context into cultivation, practical training }.

**Define evaluation grade set**

When research on Chinese three big balls reserve talents cultivation path, utilize experts evaluation method to define evaluation grade set. According to:

$$V = \{v_1, v_2, \cdots, v_n\}, n = 1,2,3,4$$

Chinese three big balls reserve talents cultivation path evaluation grade set is = {Very good, relative good, general, not too good}.

**Define each evaluation indicator weight**

Weight main expression method is:

$$w = \{\mu_1, \mu_2, \cdots, \mu_m\}, m = 1,2,\cdots,6$$

Among them: $\sum_{m=1}^{6} \mu_m = 1$

Define evaluation indicator weight method mainly has analytic hierarchy process and normalization method, from which normalization method is as following:

$$w_i = \frac{\frac{C_i}{\overline{S_i}}}{\sum_{i=1}^{n} \frac{C_i}{\overline{S_i}}}, (i = 1,2,\cdots,m)$$

Among them, $w_i$ is evaluation parameter $i$ monitoring value; $\overline{S_i}$ is evaluation parameter $i$ grade $m$ criterion arithmetic average value, then weight set is :

$$w = \{w_1, w_2, \cdots, w_m\}。$$

In addition, apply normalization method to calculate weights, Chinese three big balls reserve talents cultivation mode evaluation indicator weight is :

$$w = \{0.06,\ 0.04,\ 0.15,\ 0.25,\ 0.30,\ 0.20\}$$

## AHP method-based Chinese three big balls cultivation path evaluation matrix

Comprehensive evaluation matrix $R$ evaluation methods mainly have expert evaluation method, analytic hierarchy process, and membership function method.

In above three methods, expert evaluation method is based on questionnaire survey and experts evaluation result statistics, so to let computed result to be more accurate, here uses analytic hierarchy process, define fuzzy relation matrix $R$, from which:

$$R = (R_1,\ R_2,\ R_3,\ R_4,\ R_5,\ R_6)^T$$

AHP method guiding thought as Figure 1 shows.

## Establish hierarchical structure

Target layer: Chinese three big balls reserve talents cultivation path

Criterion layer: Scheme influence factors, $C_1$ is basic group training, $C_2$ is the general theory of culture, $C_3$ is team training, $C_4$ is race against the type of culture, $C_5$ is Context into cultivation, $C_6$ is practical training.

Scheme layer: $A_1$ is very good, $A_2$ is relative good, $A_3$ is general, $A_4$ is not too good

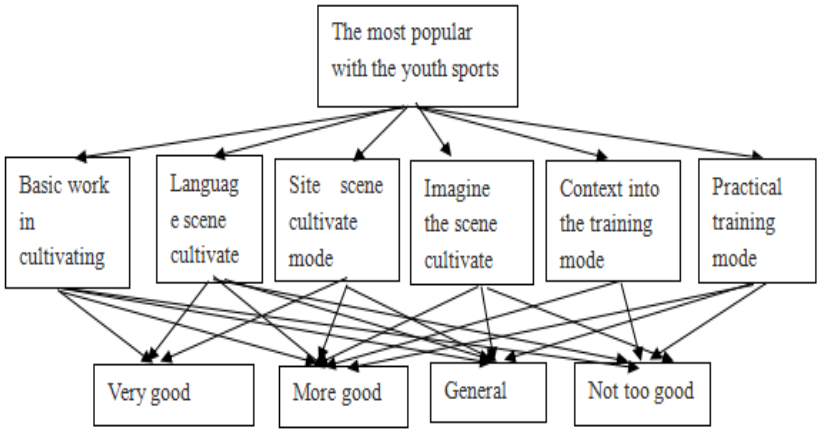


**Figure 1 : Class hierarchy**

**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.

**TABLE 1 : 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 |

According to above scale TABLE 1, set judgment matrix $A$ as:

$$A = \begin{pmatrix} 1 & 2 & \frac{1}{2} & \frac{1}{4} & \frac{1}{5} & \frac{1}{3} \\ \frac{1}{2} & 1 & \frac{1}{2} & \frac{1}{5} & \frac{1}{7} & \frac{1}{4} \\ 2 & 2 & 1 & \frac{1}{4} & \frac{1}{5} & \frac{1}{3} \\ 4 & 5 & 4 & 1 & \frac{1}{2} & 2 \\ 5 & 7 & 5 & 2 & 1 & 3 \\ 3 & 4 & 3 & \frac{1}{2} & \frac{1}{3} & 1 \end{pmatrix}$$

And constructed scheme layer judgment matrixes correspond to different criterion layers are as following TABLE 2-4:

**TABLE 2 : Criterion layer judgment matrix $C_1$ and $C_2$**

| $C_1$ | $A_1$ | $A_2$ | $A_3$ | $A_4$ | $C_2$ | $A_1$ | $A_2$ | $A_3$ | $A_4$ |
|---|---|---|---|---|---|---|---|---|---|
| $A_1$ | 1 | 3 | 4 | 5 | $A_1$ | 1 | 2 | 3 | 5 |
| $A_2$ | 1/3 | 1 | 4 | 4 | $A_2$ | 1/2 | 1 | 4 | 5 |
| $A_3$ | 1/4 | 1/4 | 1 | 3 | $A_3$ | 1/3 | 1/4 | 1 | 3 |
| $A_4$ | 1/5 | 1/4 | 1/3 | 1 | $A_4$ | 1/5 | 1/5 | 1/3 | 1 |

**TABLE 3 : Criterion layer judgment matrix $C_3$ and $C_4$**

| $C_3$ | $A_1$ | $A_2$ | $A_3$ | $A_4$ | $C_4$ | $A_1$ | $A_2$ | $A_3$ | $A_4$ |
|---|---|---|---|---|---|---|---|---|---|
| $A_1$ | 1 | 2 | 3 | 5 | $A_1$ | 1 | 2 | 3 | 3 |
| $A_2$ | 1/2 | 1 | 3 | 3 | $A_2$ | 1/2 | 1 | 3 | 4 |
| $A_3$ | 1/3 | 1/3 | 1 | 1/3 | $A_3$ | 1/3 | 1/3 | 1 | 1/3 |
| $A_4$ | 1/5 | 1/3 | 3 | 1 | $A_4$ | 1/3 | 1/4 | 3 | 1 |

**TABLE 4 : Criterion layer judgment matrix $C_5$ and $C_6$**

| $C_5$ | $A_1$ | $A_2$ | $A_3$ | $A_4$ | $C_6$ | $A_1$ | $A_2$ | $A_3$ | $A_4$ |
|---|---|---|---|---|---|---|---|---|---|
| $A_1$ | 1 | 2 | 3 | 4 | $A_1$ | 1 | 3 | 4 | 7 |
| $A_2$ | 1/2 | 1 | 2 | 3 | $A_2$ | 1/3 | 1 | 3 | 4 |
| $A_3$ | 1/3 | 1/2 | 1 | 1/3 | $A_3$ | 1/4 | 1/3 | 1 | 1/3 |
| $A_4$ | 1/4 | 1/3 | 3 | 1 | $A_4$ | 1/7 | 1/4 | 3 | 1 |

Calculate weight
To judgment matrix:

$$A=\begin{pmatrix} 1 & 2 & \frac{1}{2} & \frac{1}{4} & \frac{1}{5} & \frac{1}{3} \\ \frac{1}{2} & 1 & \frac{1}{2} & \frac{1}{5} & \frac{1}{7} & \frac{1}{4} \\ 2 & 2 & 1 & \frac{1}{4} & \frac{1}{5} & \frac{1}{3} \\ 4 & 5 & 4 & 1 & \frac{1}{2} & 2 \\ 5 & 7 & 5 & 2 & 1 & 3 \\ 3 & 4 & 3 & \frac{1}{2} & \frac{1}{3} & 1 \end{pmatrix}$$

Firstly use MATLAB software to make following processing:

$$\xrightarrow{Column\ \ vector\ \ normalization}\begin{pmatrix} 0.882 & 0.925 & 0.874 & 0.733 & 0.619 & 0.427 \\ 0.736 & 0.811 & 0.821 & 0.722 & 0.509 & 0.653 \\ 0.652 & 0.657 & 0.773 & 0.604 & 0.527 & 0.662 \\ 0.551 & 0.431 & 0.694 & 0.585 & 0.448 & 0.586 \\ 0.288 & 0.305 & 0.548 & 0.454 & 0.339 & 0.496 \\ 0.186 & 0.063 & 0.167 & 0.145 & 0.185 & 0.386 \end{pmatrix}$$

$$\xrightarrow{According\ \ to\ \ the\ \ row\ \ sum}\begin{pmatrix} 2.858 \\ 2.153 \\ 1.223 \\ 0.991 \\ 0.863 \\ 0.627 \end{pmatrix}\xrightarrow{The\ \ normalized}\begin{pmatrix} 0.211 \\ 0.156 \\ 0.705 \\ 0.572 \\ 0.447 \\ 0.356 \end{pmatrix}=W^0$$

Then, by $A\times W^0=\begin{pmatrix} 0.211 \\ 0.156 \\ 0.705 \\ 0.572 \\ 0.447 \\ 0.356 \end{pmatrix}$ it further solves $\lambda^0{}_{\max}=4.028$。

Similarly, criterion layer judgment matrix corresponding maximum feature value and feature vector are successively :

$$\lambda^{(1)}{}_{\max}=2.865,\omega_1^1=\begin{pmatrix}0.565\\0.403\\0.909\\0.878\\0.744\\0.638\end{pmatrix};\quad \lambda^{(2)}{}_{\max}=2.872,\omega_2^1=\begin{pmatrix}0.156\\0.057\\0.875\\0.753\\0.592\\0.387\end{pmatrix};$$

$$\lambda^{(3)}{}_{\max}=2.854,\omega_3^1=\begin{pmatrix}0.405\\0.158\\0.876\\0.754\\0.698\\0.522\end{pmatrix};\quad \lambda^{(4)}{}_{\max}=2.841,\omega_4^1=\begin{pmatrix}0.416\\0.227\\0.898\\0.743\\0.625\\0.545\end{pmatrix};$$

$$\lambda^{(5)}{}_{\max}=2.865,\omega_5^1=\begin{pmatrix}0.365\\0.329\\0.872\\0.747\\0.633\\0.558\end{pmatrix};\quad \lambda^{(6)}{}_{\max}=2.887,\omega_6^1=\begin{pmatrix}0.437\\0.256\\0.891\\0.730\\0.554\\0.509\end{pmatrix}$$

**Comprehensive evaluation matrix**

By above computed results, it is clear:

$$R_1=\begin{pmatrix}0.565\\0.403\\0.909\\0.878\\0.744\\0.638\end{pmatrix};\quad R_2=\begin{pmatrix}0.156\\0.057\\0.875\\0.753\\0.592\\0.387\end{pmatrix};\quad R_3=\begin{pmatrix}0.405\\0.158\\0.876\\0.754\\0.698\\0.522\end{pmatrix};$$

$$R_4=\begin{pmatrix}0.416\\0.227\\0.898\\0.743\\0.625\\0.545\end{pmatrix};\quad R_5=\begin{pmatrix}0.365\\0.329\\0.872\\0.747\\0.633\\0.558\end{pmatrix};\quad R_6=\begin{pmatrix}0.437\\0.256\\0.891\\0.730\\0.554\\0.509\end{pmatrix}$$

And further by $R=(R_1,\ R_2,\ R_3,\ R_4,\ R_5,\ R_6)^T$ it can get comprehensive evaluation matrix as following:

$$R=\begin{pmatrix} 0.565 & 0.156 & 0.405 & 0.416 & 0.365 & 0.437 \\ 0.403 & 0.057 & 0.158 & 0.227 & 0.329 & 0.256 \\ 0.909 & 0.875 & 0.876 & 0.898 & 0.872 & 0.891 \\ 0.878 & 0.753 & 0.754 & 0.743 & 0.747 & 0.730 \\ 0.744 & 0.592 & 0.698 & 0.625 & 0.633 & 0.554 \\ 0.638 & 0.387 & 0.522 & 0.545 & 0.558 & 0.509 \end{pmatrix}$$

**Make comprehensive evaluation**

Known $W=(\mu_j)_{1\times m}$, $R=(r_{ji})_{m\times n}$, by

$$S=w\circ R=(\mu_1,\mu_2,\cdots,\mu_m)\circ\begin{pmatrix} r_{11} & r_{12} & \cdots & r_{1n} \\ r_{21} & r_{22} & \cdots & r_{2n} \\ \vdots & \vdots & \vdots & \vdots \\ r_{m1} & r_{m2} & \cdots & r_{mn} \end{pmatrix}=(s_1,s_2,\cdots,s_n)$$

It can get fuzzy evaluation set $S$, from which"$\circ$" is fuzzy composition operator. Here take fuzzy operator as $M(\cdot,\oplus)$ operator, that:

$$s_k=\min\left(1,\sum_{j=1}^{m}\mu_j r_{jk}\right),k=1,2,\cdots,n$$

Input above computed result into above formula, it can get:

$$S=(0.125,\quad 0.113,\quad 0.241,\quad 0.339,\quad 0.375\quad 0.288)$$

**Get results**

By analyzing fuzzy evaluation vector $S$, it makes comprehensive conclusion. Generally, it can adopt maximum membership principle, weighted average principle, fuzzy vector uniformization, and here apply maximum membership principle.

For maximum membership principle, if given fuzzy evaluation set $S=(S_1,S_2,\cdots,S_n)$, (from which $S_i$ is grade $v_i$ to fuzzy evaluation set membership), $M=\max(S_1,S_{2,}\cdots,S_n)$, $M$ corresponding element is comprehensive evaluation result of evaluation.

By $S=(0.125,\quad 0.113,\quad 0.241,\quad 0.339,\quad 0.375\quad 0.288)$, it can get TABLE 5。

**TABLE 5 : Evaluation result**

| Reserve talents cultivation mode | General cultivation mode | | Situational teaching cultivation mode | | | |
|---|---|---|---|---|---|---|
| | Basic group training | The general theory of culture | Team training | Race against the type of culture | Context into cultivation | Practical training |
| Evaluation weight | 12.5% | 11.3% | 24.1% | 33.9% | 37.5% | 28.8% |

Make comparative analysis of above two kinds of reserve talents cultivation schemes as following Figure 2:

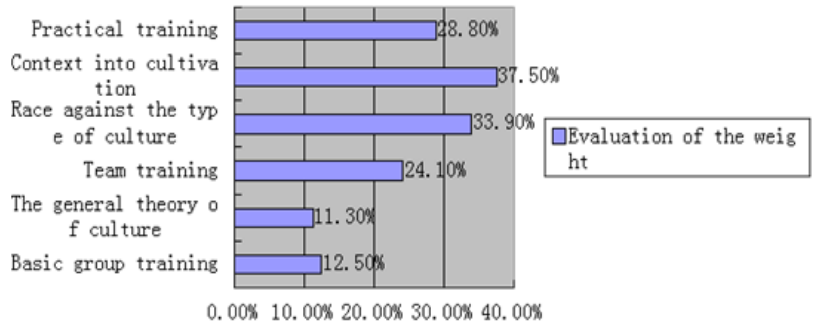


**Figure 2 : The evaluation results**

From Figure 2, it is easily known: $M_{\max} = 0.339$

By above comparative analysis, it gets conclusion: in six kinds of cultivation schemes, context into cultivation mode evaluation weight is the highest, secondly is race against the type of culture, practical training, while team training, basic group training, the general theory of culture evaluation weights are lower. It shows, in implementing three big balls reserve talents cultivation process, it should focus on adopt context into cultivation, represent actual competition scenes, set certain contexts, let students to experience and understand competition in realistic contexts.

## CONCLUSION

The paper utilizes fuzzy AHP method to study Chinese three big balls reserve talents cultivation path, firstly makes explanation of reserve talents cultivation's general cultivation mode and situational teaching cultivation mode, and utilizes fuzzy comprehensive evaluation method to evaluate three big balls reserve talents cultivation schemes, gets weight proportion highest cultivate mode that is most suitable Chinese three big balls reserve talents cultivation path.

Secondly, combine with AHP method, define six kinds of cultivation modes evaluation matrix, and respectively calculate each cultivation mode weight, finally get conclusion: context into cultivation mode evaluation weight is the highest, secondly is race against the type of culture, practical training. For Chinese three big balls reserve talents cultivation, context into cultivation is best choice that is cultivating three big balls reserve talents by representing competitions scenes, simulating realistic competition training.

## REFERENCES

**[1]** Pang Jianmin; Analysis And Comparison Research In Dynamic Development And Changes In The Number Of Excellent Athletes Of Chinese Basketball, Volleyball And Football, Journal of Anhui Sports Science, **30(4)**, 14-18 **(2009)**.

**[2]** Lin Ming, Yan Jie; An Analysis of the Factors That Influence the Development of High Jump in China, Journal of Capital College of Physical Education, **19(5)**, 105-109 **(2007)**.

**[3]** Liu Bang-Hua, Li Yan-Ling, Li Jing, Zhou Huai-Qiu, Liu Guo-Hong; Strategy for Olympic Games and Sustainable Development of Hunan Competitive Gymnastics, Journal of Beijing Sport University, **28(12)**, 1713-1714 **(2005)**.

**[4]** Ye Jiabao, et al; Objective of Chinese Sports Competitiveness at The 28th Olympic Games and Countermeasures to Develop Athletics Continually, Journal of Shandong Physical Education Institute, **18(4)**, 1-5 **(2002)**.

**[5]** Zhou Guo-Hai, Yuan Gui-Cai; Case Analysis on Family Cultivating Sport Talents-Taking Snooker Player Ding Jun-Hui as a Case, Bulletin of Sport Science & Technology, **16(11)**, 27-28 **(2008)**.

**[6]** Qiu Ming, Li Mingxue; Research on Olympics Core Competitive Ability in Antagonism Ball Game, Journal of Jilin Institute of Physical Education, **24(5)**, **(2008)**.

**[7]** Ren Zhong; The Analysis of the Main Reasons which 2008 Olympic Game U-17 Affect the Reserve Talents Fostering in Athletic Volleyball, Journal of Xuchang University, **25(2)**, 80-83 **(2006)**.

**[8]** Yan Jie, Huang Jian-Min, Lin Ming; Analysis on the Causes and Diagnosis of Technique Development of Male High-Jumping in China, Journal of Beijing Sport University, **29(12)**, 1727-1729 **(2006)**.