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## Goal programming method-based Chinese traditional martial arts cultural protection and inheritance

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### ABSTRACT

With rapidly development of Chinese economy, martial arts culture has slowly fade out of people's view, now some people only focus on profit, forget Chinese excellent traditional culture, such thought is quite bad for Chinese such extensive and profound marginal culture, therefore the paper takes it as entry point to study. The paper makes specific analysis of Chinese martial arts culture status, by studying Chinese recent years' martial artists amount change and martial artists gender proportions, utilizing numerical analysis and data handling methods, and then finds out that present Chinese martial artists are decreasing by year, it should lay emphasis on cultivating martial artists of more high technology and high quality; establishes contemporary Chinese martial arts development influential relative factors models, by goal programming method and correlation analysis method, it studies martial arts events of masses most satisfaction, final it gets conclusions that: Taijiquan, Wing Chun, and nunchaku are martial arts events of contemporary residents most satisfaction. By above comprehensive analysis, combine with contemporary martial arts development, put forward relative suggestions to propel to Chinese martial arts development that contemporary Chinese martial arts development has many obstacles, it should expand its publicity, driving martial arts development by sports tourism, and then let masses to go deeper understanding about martial arts knowledge.

### KEYWORDS

Martial arts culture; Numerical analysis; Goal programming method; Protection and inheritance; Sports tourism.



**INTRODUCTION**

Martial arts culture should be protected by everyone, because in the whole world, China is the kingdom of martial arts, and among whole world martial artists, China occupies maximum proportions, martial arts has unfathomable mysteries, which everyone masters not only can build body but also can cultivate his moral character, and improve his own qi channel.

Liu Yong in the article “ Chinese martial arts cultural international transmission status and development strategic research”, studied Chinese sports culture by the perceptive of present most popular international cultural exchange meet, finally got that only enhanced Chinese martial arts culture and international other martial arts main countries to make exchanges in experience, martial capacity and quintessence then could constantly perfect Chinese martial arts culture by absorbing quintessence from other countries, and let Chinese martial arts culture to be greatly developed, and let Chinese martial arts spirits to be spread in every corner of the world.

Wu Fang-Qing in the article “Traditional martial arts cultural study in the horizon of cultural ecology”, took contemporary cultural environment as perspective to study Chinese excellent traditional culture, and pointed out that only diversified Chinese martial arts forms and enriched contents then could let Chinese martial arts culture to be inherited and developed. The conclusion provided well references for how to let Chinese traditional martial arts culture to be sound and rapidly developed.

Ci Chun-Lei in the article “Research on Chinese martial arts cultural inheritance”, studied Chinese martial arts cultural inheritance issues in the contemporary with rapidly economic development, the article pointed out that the upmost path to martial arts inheritance was spreading martial arts spirits among national people and even in the world, only then could let Chinese excellent martial arts culture to pass on forever.

The paper makes comprehensive analysis of present Chinese martial arts cultural development conditions, and uses contemporary globalization development backgrounds to study Chinese martial arts cultures existing problems, puts forward transmission routes that propel to Chinese excellent martial arts culture in the world, and points out that it should let Chinese adolescent to understand martial arts culture as earlier as possible that is helpful for letting Chinese martial arts culture to be inherited and carried forward.

**FACTORS AFFECT CHINESE MARTIAL ARTS CULTURE**

Since martial arts was set as special event in the 2008 Olympic Games host in China, China has enlarged investment on martial arts traditional culture, which can let economy to be rapidly developed, society accordingly to be diversified, however it lets martial arts culture advertising martial artists to become less and less, which seriously affects Chinese martial arts culture inheritance, affects martial arts cultural protection, in the following it studies from martial artists ages, genders and other factors.

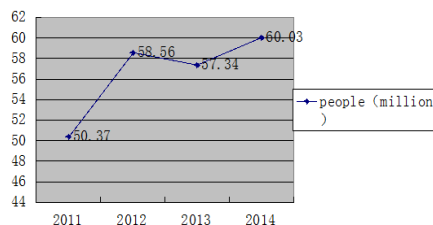
**Chinese recent years’ martial artists’ amount**

Chinese martial arts has been further developed since 2008, with augment of martial arts investment and attention, by interviewing and investigating whole nation holy lands of all kinds of martial arts, visit excellent masters and get following TABLE 1:

**TABLE 1 : Recent four years’ martial arts’ amount data table**

	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>
Number of martial artists (million people)	50.37	58.56	57.34	60.03

In order to be easier to reader read, study and compare, draw TABLE 1 recent four years’ Chinese martial artists amount statistical table into following Figure 1 showed broken line graph.



**Figure 1 : Nearly four years of martial arts toll data Figures**

From above broken line Figure 1, it is clear that since Olympic Games, our nationwide martial artists’ amount is rising tortuously, from 50.37 million in 2011 to 60.03million in 2014, the upmost is the trend of Chinese martial arts amount is rising that let inheritance of Chinese martial arts to be ensured.

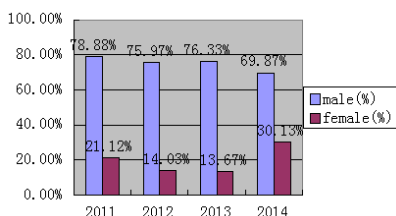
**Chinese recent years’ martial artists gender ratio**

Chinese martial arts culture is extensive and profound, is learnt by enthusiasts no matter men or women, because when practicing martial arts, it not only can dredge the channels, but also can retard aging to some extent, let spirit to be more invigorated, more active in manners, and meanwhile can enhance communicate, below TABLE 2 is gender ratio that learns martial arts in recent years in China.

**TABLE 2 : Chinese recent four years’ martial artists’ amount gender ratio**

	2011	2012	2013	2014
Men	78.88%	75.97%	76.33%	69.87%
Women	21.12%	14.03%	13.67%	30.13%

According to above TABLE 2 data analysis and research, as well as consult relative books, further handle with them and get Figure 2:



**Figure 2 : Our country in four years jack sex ratio of the number**

By above bar Figure 2 statistics, it is clear that Chinese women amount that participates in martial arts is further increased, which shows Chinese recent years’ publicity and investment has achieved remarkable results, Chinese women martial artists amount increases and meanwhile Chinese martial arts culture is gradually going deeper in all groups, which plays an irreplaceable role in future Chinese traditional martial arts cultural protection and inheritance.

**CHINESE MARTIAL ARTS CULTURE OVERSEAS TRANSMISSION**

**Chinese martial arts culture transmission influence factors**

Martial arts culture is cultural heritage of people in the world, we should spread Chinese excellent martial arts culture through present cultural globalization tide, show to people from everywhere in the world the quintessence of Chinese martial arts culture, below TABLE 3 and TABLE 4 are Chinese martial arts culture overseas transmission influence factors:

**TABLE 3 : Martial arts culture overseas transmission influence factors**

Constraint	Percentage
Different cultures between China and the west	16%
Professional coaches are lacking	20.3%
Communication of martial arts in international is insufficient	17.8%
Propaganda is not big enough	23.3%
Native sports competent department doesn’t attach great important	12.8%
Geographical differences in countries	4.1%
Action of martial arts is too complicated to learn	3.2%
Else	2.5%

**TABLE 4 : Martial arts culture overseas transmission satisfaction degree**

	Very good	Good	General	Poor	Very poor
Percentage(%)	9%	21%	23%	28%	20%

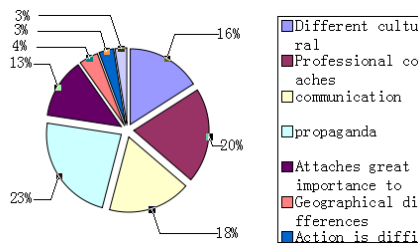


Figure 3 : The influence factors of wushu culture spread in foreign countries

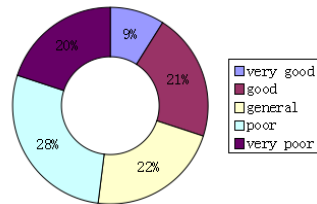


Figure 4 : Martial arts culture in the spread of foreign satisfaction

From above pie Figure 3 and Figure 4, it is clear that upmost factors that affect Chinese martial arts culture overseas transmission are Chinese martial arts publicity in foreign countries and lack of professional coaches, which totally occupy around 40% of total proportions; it provides data for China advertising martial arts culture in foreign countries.

**Martial arts coaches’ professional standards**

Chinese professional martial arts coaches standards are directly related to Chinese martial arts culture development, below Figure 5-6 TABLE 5-6 are TABLES of Chinese martial arts coaches professional standards and amount.

TABLE 5 : Martial arts coaches’ standards table

Standard	Very high	High	General	Low	Very low
Percentage(%)	5%	14%	24%	46%	11%

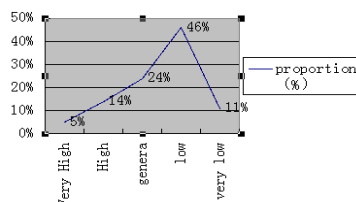


Figure 5 : The level of the martial arts coaches list

TABLE 6 : Martial arts culture overseas transmission satisfaction degree

Amount conditions	A Lot	More	General	Less	Very few
Percentage(%)	9%	21%	34%	23%	8%

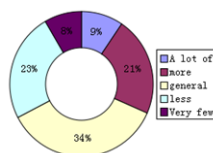


Figure 6 : The level of the martial arts coaches list

From above Figures and TABLES, there are considerably parts of martial arts professional coaches professional standards are very bad, and coaches with high professional standards are little, which reflects important causes why Chinese

martial arts develop slowly, China should increase cultivation and investment on professional coaches, only then can set examples for Chinese martial arts culture.

**ESTABLISH MODELS**

**Correlation analysis guiding thought**

Correlation analysis is utilizing software to handle with data, compares correlation by comparing correlation coefficient sizes. Common correlation coefficient has Pearson correlation coefficient and Spearman rank correlation coefficient. The paper utilizes Pearson correlation coefficient to make correlation comparison.

Pearson correlation coefficient is used to show two variables similarity extent mathematical statistical quantity, it can be used to make quantitative calculation on two variables similarities. Its calculation formula is as following :

$$\rho(X, Y) = \frac{\text{cov}(X, Y)}{\sigma_x \sigma_y} = \frac{E((X - \mu_x)(Y - \mu_y))}{\sigma_x \sigma_y}$$

Among them, covariance is used as numerator, is product of two variables standard deviation, and it requires two variables standard deviation not to be 0.

And  $\mu_x = E(X), \sigma_x^2 = E(X - \mu_x)^2 = E(X^2) - E^2(X)$

Therefore, Pearson correlation coefficient can also be written as:

$$\rho(X, Y) = \frac{E(XY) - E(X)E(Y)}{\sqrt{E(X^2) - E^2(X)}\sqrt{E(Y^2) - E^2(Y)}}$$

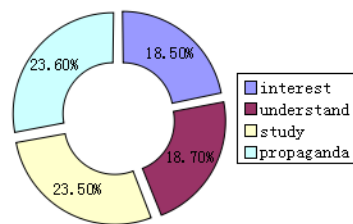
When two variables Pearson correlation coefficient gets closer to 1 or -1, it shows the two correlations is big, or closely related. It gets closer to 1 show the two are in positive correlation; on the contrary it gets closer to -1 shows the two are in negative correlation.

**Data analysis**

For Chinese martial arts culture, it should not just focus on publicity but develop through tourism, because it will also drive industries growth to a certain degree while advertising culture and different tourisms play different roles in advertising martial arts culture aspect.

**TABLE 7 : Tourism to martial arts culture effects data table**

	Increase interest	Enhance understanding	Study quintessence	Increase propaganda
Innovation(%)	18.5%	18.7%	23.5%	23.6%



**Figure 7 : Different puzzles data Figures**

Carry out correlation analysis of above TABLE 7 data, it can get TABLE 8:

**TABLE 8 : Relevant data table**

	Increase interest	Enhance understanding	Study quintessence	Increase propaganda
Innovation R	.327**	.129**	.495**	.127**
P	.003	.001	.002	.008

**\*\*It represents to arrive at significant correlation in the level of 0.01**

Above data shows that among benefits that Chinese martial arts culture gets from Chinese tourism, learn original martial arts quintessence in martial arts cradle has the highest satisfaction degree, next is vigorous propaganda on Chinese martial arts culture, only personally experience then can tell surrounding people, let them also to have immersive feelings, and further stir them to appreciate, such circulating process will promote martial arts propaganda.

**Goal programming method-based Chinese public martial arts fitness activities items study**

Chinese martial arts moves forward towards the orientation of people imagination, and shows up among people in various forms as Olympic Games, World Exposition, international auto show and else, which plays a crucial roles and of help to Chinese martial arts current and even future development.

According to investigation, Chinese public martial arts fitness contents are mainly Tai Chi, sword-dance, five-animal exercises, nunchaku, Wing Chun, stick dance, gun dance and so on. Below TABLE 9 is main items that Chinese martial arts culture penetrate into fitness, data is from general administration of sport of China and Chinese statistical yearbook data:

**TABLE 9 : Goal programming data investigation**

	Sword-dance	Five-animal exercises	Nunchaku	Stick dance	Wing Chun	Tai Chi	Gun dance
Percentage	5.7%	3.2%	26.4%	11.5%	21.4%	28.1%	3.6%
Satisfaction degree	7.8%	5.4%	25.1%	15.6%	19.7%	23.9%	2.5%

**Goal programming guiding thought**

As the name implies, goal programming is programming given system problems by mathematical methods, so that getting a group optimal scheme of actual expected targets. Goal programming overcomes linear programming limitations, which can only solve a group of linear constraint conditions. In addition, in reality life, to certain targets, it has primary and secondary, and also supplement and independent from each other. And meanwhile it also has maximum value, minimum value, and the difference of quantization and qualitative, LP cannot solve these problems, while goal programming just overcomes the shortcomings.

In general, goal programming has three methods, weighted coefficient method, priority ranking method and efficient solution method. Among them, weighted coefficient method is to define a weight on every required goal, so that transform complex multiple goal problems into single goal problem, but its weights rationality cannot well grasped; priority ranking method is to classify each goal into different grades, its classification evidence is each goal emphasis degree. Efficient solution method can take account of every goal so that get most satisfied solution.

Goal programming objective function is composed by positive and negative deviation variables according to each goal constraints and endowed corresponding prior factors. Its general basic forms are:

(1) Positive and negative deviation variable tries to be small so that just arrives at goal value

$$\min z = f(d^+ + d^-)$$

(2) Positive deviation tries to get small, it doesn't need to arrive at goal value

$$\min z = f(d^+)$$

(3) Negative deviation tries to get small, above goal value and surplus amount is not limited

$$\min z = f(d^-)$$

Among them, positive and negative deviation variables definitions are as following:

Known that  $d$  is function of decision-making variable, positive deviation variable  $d^+ = \max\{d - d_0, 0\}$  represents the part that decision value surpasses goal value, negative deviation variable  $d^- = -\min\{d - d_0, 0\}$  represents the part that decision value hasn't arrived at goal value, and  $d_0$  is  $d$  goal value, it always has  $d^+ \times d^- = 0$ .

Priority factor:  $P_1, P_2, \dots$ , and it has  $P_k \gg P_{k+1}, k = 1, 1, \dots, q$ , represents that  $P_k$  has bigger priority than  $P_{k+1}$ .

Goal programming general mathematical model:

Known  $x_j (j = 1, 2, \dots, n)$  is goal programming decision-making variable, equality constraints, or inequality constraints. There are  $l$  pieces of gentle goal constraints, their goal programming constraints deviations are  $d^+$ ,

$d_i^- (i = 1, 2, \dots, l)$ . Set there are  $q$  pieces of priority ranks that are respectively  $P_1, P_2, P_3, \dots, P_q$ . In the same priority  $P_k$ , there are different weights respectively are  $\omega_{kj}^+, \omega_{kj}^- (j = 1, 2, \dots, l)$ . Therefore goal programming general mathematical expression is :

$$\min z = \sum_{k=1}^q P_k \left( \sum_{j=1}^l \omega_{kj}^- d_j^- + \omega_{kj}^+ d_j^+ \right)$$

$$\begin{cases} \sum_{j=1}^n a_{ij} x_j \leq (=, \geq) b_i, i = 1, \dots, m \\ \sum_{j=1}^n c_{ij} x_j + d_i^- - d_i^+ = g_i, i = 1, \dots, l \\ x_j \geq 0, j = 1, 2, \dots, n \\ d_i^-, d_i^+ \geq 0, i = 1, 2, \dots, l \end{cases}$$

### Goal programming data handling

According to above goal programming guiding thought, carry out data processing with national masses data statistical table on all items of martial arts fitness, here adopts sequential algorithm. Sequential algorithm is transforming complex goal programming problems into multiple single goal programming problems according to priorities order; its main process is as following:

For  $k = 1, 2, \dots, q$ , solve:

$$\min z = \sum_{j=1}^l P_k \left( \sum_{j=1}^l \omega_{kj}^- d_j^- + \omega_{kj}^+ d_j^+ \right) \quad (1)$$

$$\sum_{j=1}^n a_{ij} x_j \leq (=, \geq) b_i, i = 1, \dots, m \quad (2)$$

$$\sum_{j=1}^n c_{ij} x_j + d_i^- - d_i^+ = g_i, i = 1, \dots, l \quad (3)$$

$$\sum_{j=1}^l (\omega_{sj}^- d_j^- + \omega_{sj}^+ d_j^+) \leq z_s^*, s = 1, 2, \dots, k-1 \quad (4)$$

$$x_j \geq 0, j = 1, 2, \dots, n \quad (5)$$

$$d_i^-, d_i^+ \geq 0, i = 1, 2, \dots, l \quad (6)$$

Among them, Optimal value is  $z_k^*$ .

At first, the most important is resident satisfaction degree, so its priority rank the first grade  $P_1$ ; Secondly, coaches guiding factors influence is the second grade  $P_2$ ; Finally, it will also suffer field constraint that is the third grade  $P_3$ . Require that resident's satisfaction degree to be above 15%. Thereupon it gets corresponding goal programming model:

$$\min z = P_1 d_1^- + P_2 (d_2^+ + d_2^-) + P_3 (3d_3^+ + 3d_3^- + d_4^+)$$

$$5.7x_1 + 3.2x_2 + 26.4x_3 + 11.5x_4 + 21.4x_5 + 28.1x_6 + 3.6x_7$$

$$7.8x_1 + 5.4x_2 + 25.1x_3 + 15.6x_4 + 19.7x_5 + 23.9x_6 + 2.5x_7 = 20$$

$$x_1, x_2, \dots, x_i, d_i^+, d_i^- \geq 0, i=1, 2, \dots, 7$$

By MATLAB software calculating above objective functions, and further get goal programming optimal solution is:  $z^* = (3, 5, 6)$ , and resident satisfaction degree is 23%.

From above objective functions optimal solution, it can get conclusion: Tai Chi, Wing Chun, and nunchaku are best choices for contemporary people carrying out martial arts fitness, and people satisfaction degrees on the three sports activities are universally higher. Analyze from the perspective of fields, these three sports activities devices, field construction and others are very simple, no strict demands, and are fit for masses activities, these martial arts events are easier to operate, are helpful for mind and body.

## CONCLUSION

(1) At first, the paper analyzes current Chinese martial arts culture status, Chinese martial arts development influence factors and Chinese professional martial artists amount and their education backgrounds, it gets that sports tourism can propel to Chinese martial arts development, and due to number of martial artists are fewer and their professional standards are poor that directly affect Chinese martial arts further development.

(2) Secondly, the paper utilizes goal programming method, correlation analysis method, it analyzes Chinese residents martial arts fitness several main activities forms, and combines with masses satisfaction degrees, it studies Chinese residents higher satisfaction martial arts events, among them Tai Chin, nunchaku, and Wing Chun are most universal martial arts events, these martial arts have important impacts on people's physical health.

(3) Finally, the paper through data analysis and handling, combines with above analytic conclusions, it puts forward specific improvement suggestions and methods for Chinese martial arts development, and presents that China should strengthen international cultural communication and publicity, overcome obstacles that Chinese martial arts comes across in the development process, and let Chinese martial arts culture to spread to every corner of the world.

## ACKNOWLEDGMENT

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