

# Developing Model of Public Physical Education Teaching Based on Mathematical Theory in the Perspective of College Students

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## Abstract

As an important part of college education, physical education (PE) teaching aims to enhance students' health and physique. This is key factor accelerating students' growths. PE combines with other subjects of education to cultivate varied talents required by sociology. In this research, the development of Sanda (free combat) teaching in the contemporary society was investigated based on Sanda teaching of modern college students. Firstly, this research conducted the statistics on the cognition degree of Sanda culture for college teachers and students to obtain satisfied results. So that the popularizing degree of Sanda culture in college teaching are recognized; afterwards, using correlation analysis and adaptive filter algorithm, the Sanda subject preferred by college students was analyzed. The results show that college students are likely to prefer Sanda subject which is characterized by low technical content and field limits due to the influence of technical content. The result indicates high stratifying degree and shows that the college teachers and students' cognition to Sanda culture requires to be enhanced. In addition, the emphasis degree of Sanda teaching should be strengthened. This research provides development research of public PE teaching with a theoretical support.

*Keywords:* College students; public PE teaching; Sanda

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## 1 Introduction

Public PE teaching is considered as an important measure of inheriting and developing PE culture in China. However increasingly diverse teaching courses lead to the fact that the China public PE teaching in the psychological status of college students decreases gradually. More characteristic courses which are similar to public PE have been replaced by cultural courses.

Many scholars have performed lots of studies have been made on PE teaching and acquired great achievements. Those researches are conducive for the future studies of relevant scholars in same filed and provide health and development of human beings with power. For instance, the research entitled "The evaluation suggestion of college PE teachers in 21st century by Li Yuhua presented that PE teaching of colleges and universities is a perfect combined process of intellectual and physical aesthetic education, intellectual education and Moral education. Meanwhile, this research also proposed that a comprehensive evaluation mechanism of PE teachers needs to be constructed so as to assess the indexes such as performance, duty and quality etc.; Zhang Jun considered that the objective of PE teaching is to facilitate the rapid development of PE teaching, and evaluate the teaching effects and quality of PE teachers in work impartially, objectively and comprehensively; however, Shen Xiaoqiang holds that the evaluation of PE teaching is to collect the relevant information of PE teaching in an open

and just way, and is a systematical evaluation process. His research is helpful for improving PE teaching performance and PE quality of students; The research into PE evaluation written by Chen Yukun is of promising theoretical significance to the improvement of PE teaching quality. As the people facing new historical figures in the new century, people in China are establishing new innovative country. With the increasing development of PE teaching courses, we are expected to focus on the ways of improving evaluation system of PE teaching and constructing the proper evaluation theories and methods. Besides, the way of illustrating the PE education teaching in comprehensive, objective and just way has been demonstrated in depth and concretely.

In this research, the factors influencing public PE teaching were analyzed based on previous research. However, owing to existing evaluation are determined by experiences instead of quantitative evaluation proved by data, it is difficult to make full objective evaluation. This study attempts to analyze the Sanda teaching level in public PE teaching using mathematical model. In application, the reasonability and effectiveness of the model have been reified.

## 2 The Construction Of Mathematical Model

The college students closely associate with the destiny and fate of one county. In order to develop the Public PE and

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culture, enhance the understanding and physical quality of college students so as to attract their focus on China remarkable culture from childhood and realize all around development of moral, intellectual, physical, aesthetics and labor education, it is required to penetrate the public PE teaching into schools as soon as possible. This research takes Sanda teaching as a research object.

2.1 THE FACTORS INFLUENCING THE DEVELOPMENT OF SANDA TEACHING IN

TABLE 1 The students' recognition for Sanda in small and middle scale college

Small scale college	Quite familiar	Familiar	Less familiar	Unfamiliar	Totally unfamiliar
Students number	13	24	38	18	7
Percentage (%)	13%	24%	38%	18%	7%

TABLE 2 The students' recognition for Sanda in small and middle scale college

Middle scale college	Quite familiar	Familiar	Less familiar	Unfamiliar	Totally unfamiliar
Students number	16	33	36	10	5
Percentage (%)	16%	33%	36%	10%	5%

Based on the investigation of abovementioned two colleges, it is obtained that the majority of students are familiar or less familiar with Sanda; few students are quite familiar with it. This is due to lack of promotion in college. The investigation shows that the Sanda culture in teaching requires to be strengthened in some aspect.

2.1.2 Evaluation of college students concerning sanda

Teachers and students in different schools show different evaluation on modern Sanda teaching. Table 3 lists the

COLLEGE STUDENTS

2.1.1 Collge students' understanding to Sanda

Sanda culture can be dated from very long time ago. Only when college students understand and are interested in it, can they inherit it. Table 1 shows the students' recognition for Sanda in small and middle scale colleges. The data were obtained by internet statistics.

evaluation of teachers and students on Sanda teaching.

TABLE 3 The results statistics of questionnaire evaluation for teachers and students

Teachers' evaluation	Feasible	Basicly feasible	infeasible
Teachers' number	4	4	2
Percentage (%)	40%	40%	20%

To present the relationship more apparently, the pie chart is drawn as Figure 1

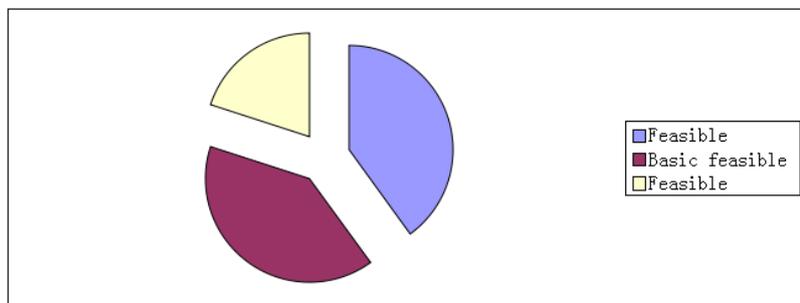


FIGURE 1 Questionnaire results of the evaluation of teachers and students

TABLE 4 The results statistics of questionnaire evaluation for teachers and students

Students' evaluation	More reasonable	Reasonable	Relatively reasonable	Unreasonable
Student number	3	2	4	1
Percentage (%)	30%	20%	40%	10%

The pie chart is drawn to clearly present the relationship as figure 2.

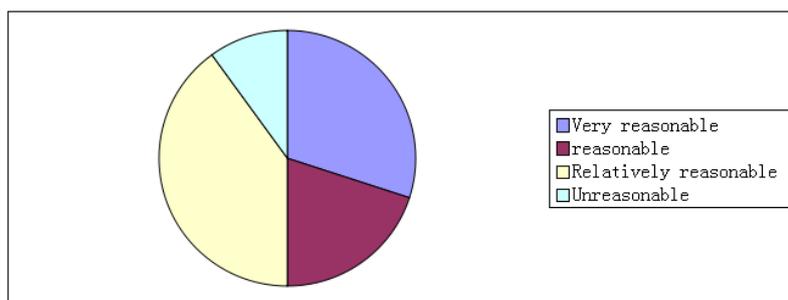


FIGURE 2 Questionnaire results of the evaluation of teachers and students Statistics

As seen in figure 2, More than 40% of teachers show preferable attitude towards Sanda. The figure indicates the satisfying levels of teachers concerning Sanda teaching and provides the development of Sanda teaching with teacher power; for the evaluation of students, almost 60% of students think the present Sanda teaching is reasonable. This supports the development of Sanda culture.

2.1.3 Sanda teaching target location of colleges and universities in China

In China, the physical quality of students is greatly cultivated owing to governments, associations, communities and social organizations attach great importance to the physical health of college students. The teaching targets of middle and small colleges are shown in Table 5.

TABLE 5 The Sanda teaching targets orientation of small and middle scale of college in China

Teaching objective	Social adaptation	Well health	Psychologically health	Exercise participation	Exercise skills
Schools number	4	8	6	9	11
Selecting frequency (%)	33.2%	66.8%	51%	74%	91.7%
Ranking	5	3	4	2	1

TABLE 6 The Sanda teaching targets orientation of small and middle scale of college in China

	University	Middle scale college	small scale college
Schools number	2	5	3
Selecting frequency (%)	20%	50%	30%
Ranking	3	1	2

The investigation table shows the teaching targets setting of several colleges. Exercise skills intention in most of schools is satisfied. The social adaptability in teaching of a small part of schools reaches the goal. This shows that the Sanda in schools' teaching needs to be developed in balance way.

2.2 COLLEGE STUDENTS' COGNITION ON SANDA TEACHING

2.2.1 Instructions of correlative analysis

Correlative coefficients such as Pearson and Spearman are applied. This research uses correlative coefficient Pearson to conduct correlative comparison.

Pearson denotes the mathematical statistic quantity of showing the similarity between two variables and is used to quantitatively calculate the similarity between two variables. The calculating equation is presented as:

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

$$\text{Also, } \mu_x = E(X), \sigma_x^2 = E(X - \mu_x)^2 = E(X^2) - E^2(X)$$

So, Pearson can also be expressed as:

$$\rho(X, Y) = \frac{E(XY) - E(X)E(Y)}{\sqrt{E(X^2) - E^2(X)}\sqrt{E(Y^2) - E^2(Y)}} \quad (1)$$

When the correlative coefficient Pearson between two variables is close to 1 or -1, two variables have greater correlation or close correlation. When it is close to 1, indicating they show positive correlation; in other words, they present negative correlation when Pearson approximates to -1.

2.2.2 Correlative analysis on PE information and PE attitudes accepted by college students

The authors perform the correlative analysis on data table and attitude data table of Sanda subjects selected by college students. On the basis of above process, Spss software is used to obtained the results as the table 7.

TABLE 7 The penetration of each Sanda subject in physical fitness

	Youth Changquan	Martial arts and Instruments	Women's self defense	Sanda	Arrest and wrestle
Attitudes towards PE <i>R</i>	.119**	.326**	.122*	.148**	.495**
<i>P</i>	.001	.004	.036	.008	.002

\*\* indicates that the penetration at 0.01 level shows significant correlation

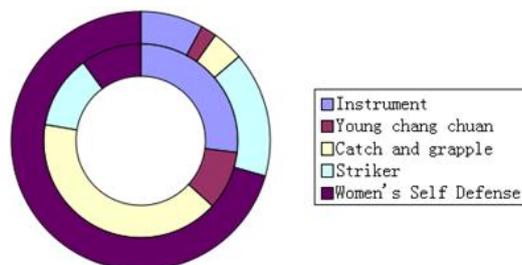


FIGURE 3 The relationship

TABLE 8 Correlative analysis data for Sanda time of college students

	Women's self defense	Youth Changquan	Martial arts and Instruments	Sanda	Arrest and wrestle
Attitudes towards <i>R</i>	.118*	.395**	.225**	.313**	.341**
<i>P</i>	.043	.013	.002	.001	.006

\*\* denotes that the data at 0.01 level shows significant correlation

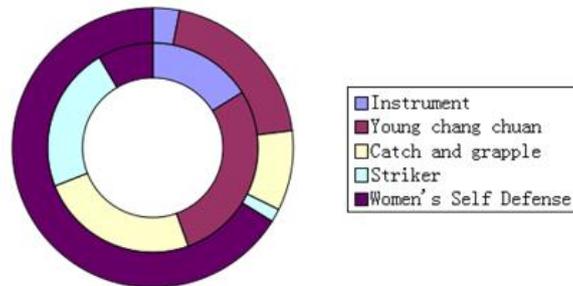


FIGURE 4 The relationship

The figures abovementioned show that: instruments, Sanda, Taijiquan, and Youth Changquan, as the subjects mostly satisfied by college students, are likely to be operated in Sanda teaching in China college and universities. This is because the teaching subjects have low requirements on field selection and technology. They accord with the tendency and situations of modern society development. This provides valuable guidance to introduce more subjects in Sanda teaching in China.

### 2.2.3 The satisfactory level of College students on different subjects in Sanda.

Sanda in teaching and physical exercise of college students consists of many subjects including Sanda, Youth Changquan, arrest and wrestle, Yongchunquan, Taijiquan, Women's self defense etc. Table 9 represents the satisfactory level of college students on each subject in Sanda.

TABLE 9 Correlation analysis data

	Women's self defense	Sanda	Arrest and wrestle	Sanda	Youth Changquan	Taijiquan
Satisfactory <i>R</i>	-.061*	.175**	.121**	.079**	.116**	-.116**
<i>P</i>	.015	.000	.001	.002	.000	.001
	Swordplay	Five-step boxing	Nunchakus	Yongchunquan	Baduanjin exercise	Others
Satisfactory <i>R</i>	-.105**	-.045	-.069*	-.054	-.057	.089**
<i>P</i>	.000	.089	.025	.068	.119	.003

For the teaching recognition of above subjects, Changquan, Sanda and Taijiquan are mostly preferable by college students. Due to the high requirements of five-step boxing and Yongchunquan, college students show less satisfactory on them. This research suggests that the Government should promote different subjects to reach equilibrium development.

## 2.3 INVESTMENT OF SANDA TEACHING IN CHINA BASED ON ADAPTIVE FILTER ALGORITHM

### 2.3.1 Instructive principle of adaptive filter algorithm

Like moving average method and exponential smoothing method, adaptive filter algorithm is to conduct weighted average for performing predication based on historical observed value which varies with time. In this algorithm, the optimal weight requires to be determined: the error is minimum. Adaptive filter algorithm calculates the corresponding predicating value using a group of known historical data, and computes the errors. Afterwards, the predetermined weights will be adjusted based on the calculated errors. In this way, the errors of predicated

values can be reduced as low as possible. It is hard to obtain the optimal weight by calculating at only one time. So the predication, calculation and adjustment of determined weights were conducted repeatedly, we obtained a set of weights with minimum error predicated, this is optimal weight.

Basic predicating formula of adaptive filter algorithm is presented as:

$$\hat{y}_{t+1} = \omega_1 y_t + \omega_2 y_{t-1} + \dots + \omega_N y_{t-N+1} = \sum_{i=1}^N \omega_i y_{t-i+1}, \quad (2)$$

Where  $\hat{y}_{t+1}$  denotes the predicting value of  $(t+1)^{th}$ ; while  $\omega_i$  is observed weight of  $(t-i+1)^{th}$ ;  $y_{t-i+1}$  is observed value of  $(t-i+1)^{th}$ ;  $N$  is the number of weights. The

$$\omega'_i = \omega_i + 2k * e_{i+1} y_{t-i+1}, \quad (3)$$

Where  $i = 1, 2, K, N$ ,  $t = N, N+1, K, n, n$  is the number of sequence data;  $\omega_i$  is the  $i^{th}$  weights before adjusting; while  $\omega'_i$  is  $i^{th}$  weights adjusted;  $k$  is learning constant;  $e_{i+1}$  represents predicating errors of  $(t+1)^{th}$ .

The equation shows that adjusted weight is the sum of original adjusting weight and error adjusting item which includes predicating errors, original historical observing value and learning constant.

2.3.2 Processing data of adaptive filter algorithm

TABLE 10 The input list of Sanda teaching in China

Input of Sanda teaching in China (hundred million Yuan)	2008	2009	2010	2011	2012
	3.9	3.8	5.6	5.7	4.9

$N = 2$ , initial weight is set as  $\omega_1 = 0.97$ ,  $\omega_2 = 0.96$ ; and  $k = 0.9$ ,  $t$  value is selected from  $N = 2$ ; that's so say, when  $t = 2$ ,

(1)the predicting value in the case of  $t+1=3$  is firstly resolved according to predicting equation,

$$\hat{y} = \hat{y}_3 = \omega_1 y_2 + \omega_2 y_1 = 588.24 \tag{4}$$

(2)then, the predicting error is calculated.

$$e_{t+1} = e_3 = y_3 - \hat{y}_3 = 2.78 \tag{5}$$

$$\omega'_i = \omega_i + 2k \cdot e_{t+1} y_{t-i+1} \tag{6}$$

(3)Afterwards, the was calculated also.

$$\omega'_1 = \omega_1 + 2k \cdot e_3 y_2 = 0.975 \tag{7}$$

$$\omega'_2 = \omega_2 + 2k \cdot e_3 y_1 = 0.964 \tag{8}$$

When  $t = 3$ , the steps abovementioned was performed again in the cause of  $t+1$

(4)Using the weights obtained, the predicting value when  $t + 1 = 4$  was obtained. That is the observed value  $y_1$  in very first of community. By adding a new observed value  $y_3$ , we obtain

$$\hat{y}_{t+1} = \hat{y}_4 = \omega'_1 y_3 + \omega'_2 y_2 = 881.81 \tag{9}$$

(5)Calculate the error

$$e_{t+1} = e_4 = y_4 - \hat{y}_4 = 1.05 \tag{10}$$

(6)Adjust the weight.

$$\omega'_1 = \omega_1 + 2k \cdot e_4 y_4 = 0.989 \tag{11}$$

$$\omega'_2 = \omega_2 + 2k \cdot e_4 y_3 = -0.02 \tag{12}$$

When,  $t = 5$

(7)the predicting value at  $t + 1 = 6$  is calculated using weights acquired.

$$\hat{y}_{t+1} = \hat{y}_6 = \omega'_1 y_4 + \omega'_2 y_3 = 880.56 \tag{13}$$

(8)Then, this research calculates the error

$$e_{t+1} = e_5 = y_5 - \hat{y}_5 = 8.45 \tag{14}$$

(9)Adjusts the weight.

$$\omega'_1 = \omega_1 + 2k \cdot e_5 y_4 = 0.9892 \tag{15}$$

$$\omega'_2 = \omega_2 + 2k \cdot e_5 y_3 = -0.0251 \tag{16}$$

By adjusting the weights for three times, the optimal weight was finally obtained

$$\omega'_1 = 0.9892, \omega'_2 = -0.0251$$

The PE consumption during 2012 to 2016 is predicated using optimal weight group as

TABLE 11 The investment of Sanda education during 2013 to 2017

	2013	2014	2015	2016	2017
Input of Sanda teaching in China (hundred million Yuan)	6.8	7.3	8.8	9.3	10.6

The line chart is drawn to present the China PE consumption predicated to better analyze PE consumption tendency

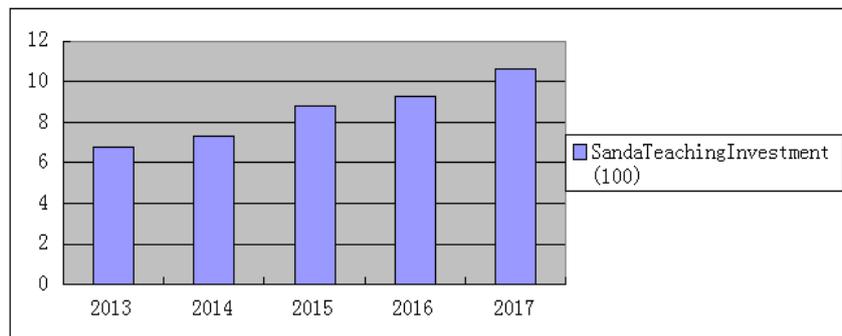


FIGURE 5 Martial arts education investment from 2013 to 2017

The line drawing refers to that the investment of schools Sanda teaching needs to be increased further based on the statistic data, so that the stable development of Sanda education in China can be realized. In this way, Sanda culture in China can be inherited by having college students understanding Sanda.

7 Conclusion

By using correlation analysis and adaptive filter algorithm, the developing factors influencing Sanda education in China was comprehensively analyzed. The results obtained show that : professional levels of teachers mainly influence the Sanda development; the Sanda subject is apt to be

popularized and developed due to its relative low requirements on teachers' technical level and fields; afterwards, the investing status of the Sanda teaching in China was obtained. Besides, the predication was

conducted on the results abovementioned. This research holds that the governments are expected to increase the investment efforts on Sanda teaching, so as to make more contribution to public PE education in China.

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