Journal of Theoretical and Applied Information Technology
20th March 2013. Vol. 49 No.2

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

BASED ON THE COLLEGE PHYSICAL EDUCATION OF COMPREHENSIVE EVALUATION OF MATHEMATICAL MODELS

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ABSTRACT

There are deficiencies and problems in the traditional physical education evaluation system. The evaluation system is used in a single evaluation. At present, social vigorously require quality education. But The past evaluation system does not reflect the quality of education objectives and requirements. In this paper, combined with the law of the higher physical education, we construct more scientific evaluation model. This paper put the quality of education and the quality of teaching as the starting point, which consist of our paper's two research module. On the one hand, the paper uses the analytic hierarchy process and fuzzy mathematical theory to build sports quality education evaluation model; on the other hand, we construct multiple sports teaching evaluation system.

Keywords: *AHP, Fuzzy Mathematics, Quality Education, Sport*

1. INTRODUCTION

At present, a research hotspot of higher physical education is evaluation system of sport education examination. Because Various phenomena in the physical quality education are intertwined by many factors such as the social, psychological and biological and they are interrelated and interaction. The variability of the factors and contact variability between factors constitute a quality education system complexity. So, the difficulty of physical education evaluation is more than other courses. Past physical education major used evaluation of the one-dimensional way, which can not reflect the objectives and requirements of quality education?

The sports teaching process is complex process of multi-factor combined effects. According to the teaching goals, the evaluation of teaching quality makes a scientific judgment about various factors in the process of teaching and its consolidated results. It includes two aspects of the teachers' behavior assessment and evaluation of student learning. The teaching behavior assessment is based on the behavior of the teachers in the teaching activities as the direct object of the assessment; learning outcomes assessment is based on students' academic performance as a basis for assessing the effectiveness of teaching. We can obtain the teachers teaching behavior and student achievement unilateral value judgment data through traditional teaching quality evaluation. However, this can not be quantitative description of the characteristics of the intrinsic relationship to the teaching and learning.

So, this paper uses the analytic hierarchy process and fuzzy mathematical theory to construct two evaluation models on quality of education and quality of teaching.

2. EVALUATION MODEL OF SPORT QUALITY EDUCATION

College physical education evaluation should reflect the thinking of the quality of education and teaching goals, so that students not only learn the basic knowledge of the sport, technology in physical education, enhance physical fitness, but also learn to behave, knowledge, aesthetic, which meet the personality development of students and adapt to the needs of the community. We use biological, psychological, social three-dimensional concept to evaluate, and mutual evaluation among teachers, students, students at the same time. The paper put the rate of student progress as a major factor, combines relative score with absolute scores, and combine diagnostic evaluation, process evaluation with lifetime evaluation.

In the evaluation of the physical education curriculum, influencing factors are a lot of and in the implementation process affect each other. In order to determine the concept of quality education physical education evaluation system indicators, according to view of three-dimensional evaluation,

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

this paper identified 50 factors. And then, we use Delphi method to investigate fifteen hundred students from three schools. We qualitatively analyze and cluster naturalization views concentrate more than 95% of the factor. Taking into account the grades of correctness and operability, we have identified three types of twelve factors comprising the evaluation system and obtain primary and secondary index system. According to contribution of the impact factor in the evaluation model, we use AHP to determine the evaluation factors weight.

AHP is a method of analyzing and evaluating multi-target, multi-level, multi-factor, multi-criteria large complex system. The calculation method is as follows:

(1) Establish independent and orderly hierarchical structure model of internal evaluation.

(2) Use off ratio standard to construct judgment matrix.

(3) Calculate the largest eigenvalue and its corresponding eigenvector of judgment matrix and then get the relative importance single activist heavy sequence of relevant factor to up level factor.

(4) Hierarchy sort and critical thinking consistency test.

So, we have the weight coefficient table, see Table 1.

Table 1: Index Weights Assigned

primary	weight	secondary	weight
Biology	0.5	physique	0.3
		knowledge	0.2
		technology	0.2
		ability	0.1
psychology	0.3	perception	0.4
		self-control	0.3
		willpower	0.2
		thinking	0.3
society	0.2	interest	0.3
		ability	0.2
		adaptability	0.3
		sport view	0.2

Evaluation of biological factors uses the existing examination evaluation method, and increase the magnitude of the biological quality of students accounted for 50% of the weight of biological quality of ratings. Teaching experiments and expert appraisal in the evaluation of these two aspects of the psychological and social factors, we develop a comprehensive evaluation table of the physical education curriculum, see Table 2.

In the school year and graduation grades, teachers give the class per person score. The score accounts for 50% of the weights psychosocial factors. Students between scoring accounts for 50%.

Table 2: Comprehensive Evaluation Table

primary score	secondary score	factor
Psychology20%	0.2	perception
	0.3	self-control
	0.2	willpower
	0.3	thinking
Society 20%	0.2	interest
	0.3	ability
	0.3	adaptability
	0.2	sport view

We divide evaluation rank into five kinds: excellent, good, moderate, qualification and poor.

Let $U=\{U_A,U_B,U_C\}$ be evaluation set, where U_A is biological factor and $U_A=\{U_{A1},U_{A2},U_{A3},U_{A4}\}$={physique, knowledge, technology, ability}; U_B is psychological factor and $U_B=\{U_{B1},U_{B2},U_{B3},U_{B4}\}$ ={perception, self-control, willpower, thinking}; U_C is social factor and $U_C=\{U_{C1},U_{C2},U_{C3},U_{C4}\}$ ={interest, ability, adaptability, view}.

Let $m=\{m_A,m_B,m_C\}$ be weight distribution set, where

$$m_A=\{m_{A1},m_{A2},m_{A3},m_{A4}\}=\{0.3,0.2,0.2,0.1\}$$

$$m_B=\{m_{B1},m_{B2},m_{B3},m_{B4}\}=\{0.4,0.3,0.2,0.3\}$$

$$m_C=\{m_{C1},m_{C2},m_{C3},m_{C4}\}=\{0.3,0.2,0.3,0.2\}.$$

Let V={ excellent, good, moderate, qualification, poor} be evaluation rank set.

If we evaluate a classmate's psychological factor, we just think about the factor of clear perception. Student evaluation are that 20% is excellent, 30% is good, 30% is moderate, 15% is qualification and 5% is poor. So we get the perception evaluation is {0.2, 0.3, 0.3, 0.15, 0.05}. Similarly, we get self-control, willpower and thinking these three factor's evaluation respectively {0.15, 0.4, 0.3, 0.15, 0}, {0.3, 0.35, 0.3, 0.05, 0} and {0.25, 0.3, 0.2, 0.15, 0.1}. Then we have the evaluation matrix

$$R=\begin{pmatrix} 0.2 & 0.3 & 0.15 & 0.3 & 0.05 \\ 0.15 & 0.4 & 0.15 & 0.3 & 0 \\ 0.3 & 0.35 & 0.05 & 0.3 & 0 \\ 0.25 & 0.3 & 0.15 & 0.2 & 0.1 \end{pmatrix}$$

According to the weight distribution, we have fuzzy matrix

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

$$R = (0.3,0.3,0.2,0.2)\begin{pmatrix} 0.2 & 0.3 & 0.15 & 0.3 & 0.05 \\ 0.15 & 0.4 & 0.15 & 0.3 & 0 \\ 0.3 & 0.35 & 0.05 & 0.3 & 0 \\ 0.25 & 0.3 & 0.15 & 0.2 & 0.1 \end{pmatrix}$$

By calculating fuzzy matrix, we have

$$R = (0.2,0.3,0.3,0.15,0.1)$$

and then through cluster analysis we get

$$R = (0.19,0.29,0.28,0.15,0.09)\,.$$

This shows that comprehensive evaluation of the psychological factors of 19% of the students is excellent, 29% of the students is good, 28% of the students is moderate, 15% of the students is qualification and 9% of the students is poor.

Using weighted average method, we first give assignment of each rank. Excellence is 95 score, good is 85 score, medium is 75 score, qualification is 60 score and poor is 50 score. So we have the assigned matrix

$$V = \begin{pmatrix} 95 \\ 85 \\ 75 \\ 60 \\ 50 \end{pmatrix}.$$

Then, we calculate the comprehensive evaluation score

$$W = (0.19,0.29,0.28,0.15,0.09)\begin{pmatrix} 95 \\ 85 \\ 75 \\ 60 \\ 50 \end{pmatrix}$$

$$= 77.2\,.$$

Finally, we again use the weight distribution to calculate the obtained score. Then, we have that the score of psychological factor is 7.72.

Similarly, we get other factors score.

3. MULTIPLE EVALUATION MODEL OF TEACHING QUALITY

In this paper, we organically combine student evaluation of teacher, teacher evaluation of student with mathematical model of teaching efficiency. Through the practice of teaching quality evaluation, we construct multiple evaluation model of teaching quality.

3.1. Construction Principle

Guiding principle: determination of the index is useful to improve enthusiasm of teachers teaching and students learning.

Scientific principle: the evaluation system should combine target evaluation with course evaluation. We not only attach importance to the teaching objectives of the physical education curriculum, but also the importance of the process of curriculum construction.

Operability principle: the evaluation system is very independent and easy to operate.

3.2. Construct Model

Multiple evaluation model combines qualitative evaluation (Qualitative description) with quantitati-ve evaluation (quantitative description).

First, we develop student evaluation of teachers table on physical quality education, see Table 3 and 4.

Table 3: Primary And Secondary Indicators

primary indicator	secondary indicator
target plan	clear teaching objectives
	earnest lectures
teaching content	emphasis and difficulty
	capacity-building
	regulation of exercise stress
teaching method	ordered step
	inspired teaching
	effective use teaching aids
teaching skill	vivid language
	skilled movement
extracurricular guide	seriously counseling
	accurate evaluation feedback
teaching effect	significant progress
	self-exercise

Table 4: Student Evaluation Of Teachers Table

Combining weight	Rank				
	A	B	C	D	E
0.05	0.35	0.65	0.4	0.1	0
0.05	0.10	0.65	0.1	0	0
0.1	0.35	0.4	0	0	0
0.09	0.2	0.8	0	0	0
0.09	0.1	0.5	0.2	0	0
0.1	0	0.6	0.5	0.2	0
0.12	0	0.7	0.1	0.1	0
0.03	0.2	0.7	0.2	0	0
0.04	0.4	0.6	0.3	0	0.1
0.05	0.3	0.2	0.1	0.1	0
0.03	0	0.2	0.5	0.2	0
0.04	0.1	0.6	0.6	0	0
0.11	0	0.1	0.7	0	0
0.1	0.1	0.3	0.5	0	0

From Table 3, we have six primary indicators and fourteen secondary indicators.

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

Using AHP, we give primary indicator weight, secondary indicator weight and combining weight.

Evaluation rank is the value judgment criteria and scales. In this model, we give five levels: A is excellent, C is medium, E is Unqualified, B between A and C, D between C and E.

By fuzzy comprehensive scoring method, it not only includes qualitatively analyzing the teachers teaching behavior and quality of main activities, and value judges desired teaching behavior and effects.

Let W_i be combining weight and V_j evaluation rank. The steps are as follows:

(1) $B_j = \sum W_i R_{ij}$, where $\sum W_i = 1$ and R_{ij} is membership degree.

(2) $G_T = \sum B_j V_j^T$, where B_j is V_j membership degree distribution of final results of evaluation in every evaluation rank, and V_j^T is transpose matrix of evaluation rank score.

(3) we use $G_T = \sum B_j V_j^T$ to calculate data of Table 4, and then get $B_j = (0.146, 0.509, 0.31, 0.02, 0.01)$, $G_T = 0.764$.

Second, physical education score changed Into grade points.

The basic content of PE Course includes learning attitude (10%), physical ability (20%~30%), technical ability (40%~50%), knowledge (10%) and so on. So, we use the dual rated method to test physical ability and technical ability. Then, we incorporate absolute score and strides rating into the physical education performance appraisal at a certain weight.

University PE performance appraisal generally use the percentage system evaluation, after using the credit system scoring approach. When we calculate the teaching efficiency, we should convert the percentage assessed into grade scores G_s .

We first calculate the proportion of student and the result see Table 5.

Table 5: Grade Score

score	>95	>89	>83	>77	>71	>65
V_j	2.00	1.65	1.34	1.00	0.66	0.32
R_j	0.03	0.06	0.11	0.20	0.22	0.26

>59	>53	>47	>41	>35	>29	<29
0.01	-0.32	-0.66	-1	-1.3	-1.65	-2
0.10	0.02	0.02	0	0.03	0.01	0

Then, from $G_s = \sum R_j V_j^T$, we get $G_s = 0.682$.

Finally, we build the mathematical model of teaching efficiency.

The teaching efficiency is a measure of the level of quality of both the teaching and learning of the main activities. It is the effective power and interference power ratio of teaching activities. The model reveals that the teaching and learning of a function of both the quality of work.

Teaching efficiency model consist of two teacher lectures efficiency model. Let $H_{(T)}$ be teacher lectures efficiency. If $-2 < G_T < 2$, $0 \le G_s < 2$, we have

$$H_{(T)} = \ln\left(1 + \frac{G_s\sqrt{(2-G_T)(2-G_s)}}{(2-G_T)^2}\right) \qquad (1)$$

If $G_s < 0$, we have

$$H_{(T)} = \ln\left(1 + \frac{G_s\sqrt{(2-G_T)(2-G_s)}}{(2-G_s)^2}\right) \qquad (2)$$

When $G_T = 2$, all students give full mark to teacher's lectures quality evaluation. When $G_T = -2$, the mark is zero. But this is an unrealistic evaluation.

We should be looking for from the operation and evaluation of the evaluation of the main mistakes on reason, and is no longer included in the calculation of teaching efficiency. We have the data, see Table 6.

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

Table 6: $H_{(T)}$ *Data*

$H_{(T)}$	-1	0	0.2	0.4	0.6	0.8
-1	-0.4	0	0.05	0.1	0.13	0.16
0	-0.31	0	0.09	0.16	0.22	0.27
0.2	-0.28	0	0.11	0.19	0.26	0.31
0.4	-0.27	0	0.12	0.22	0.3	0.36
0.6	-0.25	0	0.16	0.27	0.36	0.42
0.8	-0.23	0	0.18	0.33	0.43	0.51
1	-0.2	0	0.24	0.41	0.54	0.63
1.2	-0.18	0	0.32	0.53	0.69	0.8
1.4	-0.16	0	0.45	0.74	0.93	1.06
1.5	-0.14	0	0.56	0.89	1.1	1.25
1.6	-0.12	0	0.72	1.9	1.34	1.5
1.8	-0.08	0	1.39	1.9	2.2	2.4
1.9	-0.05	0	2.25	2.8	3.2	3.6

1	1.2	1.4	1.5	1.6	1.8	1.9
0.18	0.19	0.19	0.18	0.17	0.14	0.1
0.3	0.31	0.32	0.32	0.3	0.25	0.2
0.35	0.37	0.45	0.36	0.35	0.29	0.22
0.4	0.41	0.43	0.42	0.41	0.33	0.3
0.47	0.5	0.51	0.49	0.48	0.4	0.31
0.57	0.6	0.61	0.59	0.57	0.48	0.38
0.69	0.73	0.72	0.73	0.7	0.59	0.47
0.87	0.92	0.92	0.91	0.88	0.75	0.61
1.15	1.2	1.2	1.19	1.16	0.99	0.81
1.34	1.38	1.41	1.38	1.35	1.19	0.98
1.59	1.67	1.65	1.64	1.61	1.43	1.22
2.45	2.56	2.57	2.55	2.51	2.3	2.05
3.48	3.5	3.56	3.54	3.5	3.25	2.96

From Table 6, we can get that the relationship of lectures quality G_T , learning quality G_s and teaching efficiency $H_{(T)}$ is not simple linear relationship.

When G_s is growing, $H_{(T)}$ also grow. But if $G_s > 1.4$, $H_{(T)}$ declines. It reflects the teaching role limitations, and learning initiative will play a decisive role. This paper takes $G_T = 0.6$, $G_T = 1.2$, $G_T = 1.6$ and $G_s > 1.4$, then we get the figure of this situation changes in the characteristics, see Figure 1.

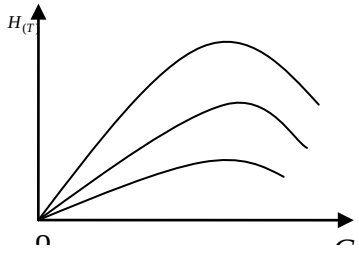

Figure 1: Trend Change

Assume $G_T = G_s$, $G_{(T,s)}$ represent teaching and learning, then we get $H_{(T)}$ (see Table 6). So we use the data to draw the curve on relationship function of $G_{(T,s)}$ and $H_{(T)}$, see figure 2.

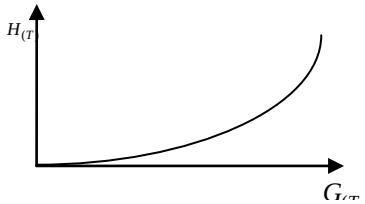

Figure 2: Relationship Function

The cure show that the higher the quality of teaching and learning, the value of teaching efficiency greater. Specially, when the value of $H_{(T)}$ is between 0.69 and 2.99, $H_{(T)}$ grows exponentially.

Then, we get evaluation criteria of $H_{(T)}$:

(1) classroom confusion: $H_{(T)} < 0$.

(2) classroom invalid state: $H_{(T)} = 0$.

(3) classroom effective state: $0 < H_{(T)} \le 0.6$.

(4) classroom developmental state:

$$0.6 < H_{(T)} \le 1 .$$

(5) classroom best state: $H_{(T)} > 1$.

The paper obtains $G_T = 0.764$ and $G_s = 0.682$ through the calculation of the data in Table 3, 4. Using teaching efficiency model, we obtain $H_{(T)} = 0.45$. Based on the five evaluation criteria of $H_{(T)}$, we get that the comprehensive evaluation of teaching quality is effective state.

4. CONCLUSION

In this paper, we mainly use AHP method and fuzzy mathematical theory to construct two evaluation models: physical quality education comprehensive evaluation model and multiple sports teaching evaluation model.

In the physical quality education comprehensive evaluation model, indicators are very well equipped, and we fully consider the various factors in the students' learning process.

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

The multiple sports teaching evaluation model is a qualitative evaluation and quantitative evaluation of the combination, and operation of important scientific value judgments.

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