



Research Article

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Gymnastics instructional design contribution to measure research based on mathematical statistics

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ABSTRACT

The teaching content reform is the main foothold of training model reform, and it is also the key point of education reform. For teaching problem gymnastics class projects, it also needs to have some improvement strategies. This paper analyzed the teaching content and teaching objectives for teaching characteristics of gymnastics class projects to find the best instructional design from both interrelated, to improve the effectiveness of teaching gymnastics classes to provide better guarantee. First this paper analyzes the classification gymnastics class project teaching content and teaching programs and methods to quantify. Then use the questionnaires and come to the interaction relationship between teaching content and teaching content, between teaching content and teaching objectives. And it analyzes the digital features and statistics to explore the optimal start teaching order. At last the course content is designed for learners of different ages through data analysis. Through this paper's analysis methods and research results provide a theoretical basis for the design drawn gymnastics teaching science.

Key words: Judgment Matrix, Teaching Objectives, Measure of Contribution, Dependence Index

INTRODUCTION

Since reopening college entrance examination system in 1997, gymnastics class has been a main course of college physical education, which occupies a very important position in the school physical education [1]. The teaching design of gymnastics class needs to optimize to achieve the effect of teaching objectives. This paper aims at the link between teaching content and teaching objectives in gymnastics class projects. This research designed a teaching consent design system for different ages.

Many studies scholars have made efforts to research the teaching content, teaching objectives and teaching design. Some of the points and research methods raised by these scholars are helpful to optimize the design of teaching gymnastics class. Some domestic scholars have also put forward their view, which provides a good theoretical basis for drawing gymnastic teaching design. Such as: Qu Luping (2009) uses the Delphi and AHP method to have discussed the basic path of gymnastic class teaching design in sports and health curriculum in schools. The research results can provide a reference for the selection and arrangement of line PE teacher gymnastics class teaching content [2]. Shen Zhiping(2006) using the Delphi method technical requirements conducted two rounds of expert questionnaire and drawn the conclusion that Computer and network technology application in physical education teaching is the key to the reform of physical education. Teachers must change their concepts, adapt physical education reform initiative to the new environment and promote outstanding professional. For much-needed items can hire experts in terms of professional learning to enrich teaching content, in order to meet the needs of student's in-depth study. School should pay attention the role of the Steering Group on teaching reform [3]. Ma Haitao (2006) using the experimental method, through the movement of different curricula, teaching methods, contents of the experimental and control groups were compared. He suggested that the present teaching gymnastics sports should dilute the teaching model, to establish a three-dimensional view of health idea. The idea is student physical health, mental health and a good ability to adapt to society as a guide for curriculum goals set [4].

Based on previous research on teaching content and teaching objectives gymnastics classes analyze the characterize, and the use of digital signature method of mathematical statistics and data were studied in order to draw scientific gymnastics class teaching design for instructional design program providing a theoretical basis.

GYMNASTICS CLASS PROJECT CHARACTERISTICS ANALYSIS

The teaching design is the process that according teaching objectives, use system methods, analyze and plan the elements before the teaching activity. Similarly teaching gymnastics class project also requires scientific design, the only way to make such popularity of the movement has been improved. If you want to come to the rational design of teaching gymnastics class projects are required to conduct research on teaching content and teaching objectives of such projects analyzed in order to find the best instructional design of the control system from the target gap.

Gymnastic Class Teaching Content Analysis

Gymnastics classes include: pommel horse, rings, vault, parallel bars, horizontal bar, balance beam and floor exercise, where the saddle horse long as 160cm, height 105cm; Rings height is 260cm. Highly Man's Vault is 135cm. Woman's vault height is 125cm, the run distance up to 25m. Parallel bars height of 250cm; balance beam height of 125cm, width of 10cm; floor exercise venue specifications is 12×12 square. The man's competition required to complete the action in 70s, while the woman's game with music required completing the action in the 90s.

The main teaching content of gymnastic projects is queue formation, broad gymnastic, light equipment gymnastic, horizontal bar, parallel bar, support jump, skill, multifunction devices, aerobics, and artistic gymnastic, group callisthenic, wall bar, and rhythmic gymnastic and dance sport.

Gymnastics teaching content can be divided into fine learning content, coarse learning content, introduces content and exercise content. Grasping sport skill is the main content of fine learning content, which is characterized by strong motor skills operability. It can meet the students' sense of accomplishment, especially some students with a strong interest in gymnastics. It is conducive to reaching motor skills, and curriculum goals. Coarse learning content sports skills to all-round development of body and mind. This kind of content requires students to master and learn. In physical exercise can put this to use, and at the same time also can let students understand the gymnastics culture, experience the fun of gymnastics, cultivate teamwork spirit of fair competition, to achieve motor skills at the same time emphasized the body health and mental health and social adaptation, the realization of the goal. Introduces content mainly use theory and multimedia teaching to introduce more content for the students. It can increase the students' knowledge, but also let students from the rational level deep understanding the essence of the gymnastics. At the same time, through learning can make the students know these projects. If students have the opportunity to learn later, it can better and faster to master. Introduces class content helps complete sports participation and social adaptation course objectives. Exercise class content in order to improve the physical quality. Its main development student flexibility, dexterity and strength of special quality basic activities and physical ability, skills for students to better learning and lay a good foundation, in order to achieve the objective of fitness and sports skill.

Gymnastics Course Objectives Analysis

The objective of gymnastics courses generally include sports participation objective (denoted by α_1), sports skill objective (denoted by α_2), body health objective (denoted by α_3), mental health objective (denoted by α_4) and social adaption objective (denoted by α_5). The C_k means the course learning objectives. Through the issuance and collection statistics expert surveys, build expert evaluation matrix, as shown in Figure 1.

C_k	α_1	α_2	α_3	α_4	α_5
α_1	1	1/4	1/3	3	5
α_2	4	1	3	7	8
α_3	3	1/3	1	4	6
α_4	1/3	1/7	1/4	1	3
α_5	1/5	1/8	1/6	1/3	1

Figure1: The importance scaling value among the objectives of expert evaluation matrix relative

Calculation each row sub-matrix objects in Fig1, as shown in formula (1).

In formula (1), ω_i is performed five times square root normalization, the results as shown in formula (2).

$$\begin{aligned}\omega_1 &= 1 \times \frac{1}{4} \times \frac{1}{3} \times 3 \times 5 = 1.25 \\ \omega_2 &= 4 \times 1 \times 3 \times 7 \times 8 = 672 \\ \omega_3 &= 3 \times \frac{1}{3} \times 1 \times 4 \times 6 = 24 \\ \omega_4 &= \frac{1}{3} \times \frac{1}{7} \times \frac{1}{4} \times 1 \times 3 = 0.0357 \\ \omega_5 &= \frac{1}{5} \times \frac{1}{8} \times \frac{1}{6} \times \frac{1}{3} \times 1 = 0.0014\end{aligned}\quad (1)$$

$$\beta_i = \frac{\sqrt[5]{\omega_i}}{\sum_{i=1}^5 \sqrt[5]{\omega_i}} \Rightarrow \begin{cases} \beta_1 = 0.1415 \\ \beta_2 = 0.4972 \\ \beta_3 = 0.2556 \\ \beta_4 = 0.0694 \\ \beta_5 = 0.0363 \end{cases} \quad (2)$$

Use the largest eigenvalue equation for the matrix consistency test. When the largest eigenvalue $\lambda_{\max} > n$, it can elicit C.I.. C.R. is the indicators of test level total sorting. R.I. means that the average random consistency index of judgment matrix is a constant. When $C.R. < 0.10$, it means passed the consistent test, as shown in formula (3).

$$\begin{cases} \lambda_{\max} = \max \{5.2417, 5.2488, 5.2346, 5.1930, 5.2436\} = 5.2436 > 5 \\ C.I. = \lambda_{\max} - \frac{n}{\sigma} - 1 = 0.0609 \leq 0.10 \\ C.R. = \frac{C.I.}{R.I.} = \frac{0.0609}{1.12} = 0.0543 < 0.10 \end{cases} \quad (3)$$

So it can determine the weight of the teaching objectives as follows.

$$\alpha_1 = 14.15\%, \alpha_2 = 49.72\%, \alpha_3 = 25.56\%, \alpha_4 = 6.94\%, \alpha_5 = 3.63\%$$

THE GYMNASTIC CLASS PROJECTS TEACHING DESIGN BASED ON MATHEMATICAL STATISTIC ANALYSIS

Parameters of Mathematical Statistic

In this paper, the degree of support for the objectives of the gymnastics teaching is divided into four grades, and these four levels for the assignment. The first grade means that the effect for objectives is key support and its quantized value is 4. The second grade means that the effect for objectives is important support and its quantized value is 2. The third grade means that the effect for objectives is ordinary support and its quantized value is 1. The fourth grade means that the effect of objectives is no support and its quantized value is 0. Sixteen experts will evaluate each teaching objectives corresponding to the degree of support role with 4,2,1,0. a_{ij} means the i th teaching content's support role degree for j th teaching objective. Use D to represent the direct contribution of teaching content for teaching objective, as shown in the formula (4).

$$D_i = \sum_{j=1}^5 a_{ij} \times \alpha_j \quad (4)$$

In order to better reflect the role of teaching content to support the teaching objectives, teaching content interaction role will be divided into four grades, the same were used to represent the quantized values 4,2,1,0. Use b_{ij} to represent the direct contribution of teaching content for teaching content. Use the size of T to represent the total contribution of teaching content for teaching objective, as shown in the formula (5).

$$T_i = \sum_{j=1}^{14} b_{ij} \times D_j \quad (5)$$

The interaction matrix elements of T values compared with D values has two aspects of differences. One is the interaction matrix of teaching content and teaching content is $M \times M$ square matrix, while the interaction matrix of teaching content and teaching objective is generally not square matrix. The other difference is that the interaction matrix diagonal elements of T values are all 4. In interaction matrix of D values, without any special relationship between the elements.

The support degree of one teaching content for another teaching content can be represented by dependence index R , as shown (6).

$$r_j = \sum_{i=1}^{14} b_{ij} \quad (6)$$

Data Analysis of Gymnastics Class Teaching

The Interactive analysis of gymnastics teaching content and teaching objectives is shown in Table 1.

Table 1- The statistics list of direct and total contribution value between teaching content and teaching objectives

Teaching Content Teaching Objectives	α_1	α_2	α_3	α_4	α_5	D_i	T_i
Queue Formation	0.078	3.016	0.667	0.151	0.100	4.012	55.51
Broad Gymnastic	0.112	4.379	0.639	0.200	0.046	5.376	45.09
Light Equipment Gymnastic	0.076	3.404	0.455	0.116	0.054	4.104	44.05
Horizontal Bar	0.047	3.987	0.355	0.131	0.038	4.558	32.22
Parallel Bar	0.049	4.573	0.426	0.138	0.042	5.229	33.09
Support Jump	0.074	4.181	0.539	0.178	0.068	5.040	34.66
Skill	0.071	5.057	0.611	0.158	0.093	5.990	45.34
Multifunction Devices	0.056	2.528	0.682	0.112	0.063	3.440	39.64
Aerobics	0.138	4.863	0.852	0.231	0.091	6.175	64.19
Artistic Gymnastic	0.100	4.573	0.710	0.154	0.065	5.602	60.01
Group Calisthenic	0.085	3.793	0.497	0.143	0.098	4.615	61.92
Wall Bar	0.058	1.752	0.397	0.100	0.026	2.333	27.53
Rhythmic Gymnastic	0.127	4.086	0.738	0.169	0.091	5.211	63.38
Dance Sport	0.087	4.280	0.625	0.185	0.083	5.260	53.18

From the data in Table 1 shows that the D value and T value are larger in aerobics, rhythmic gymnastics, artistic gymnastics teaching content. These two values means the teaching content contribution of teaching objectives. So the larger the two values, the focus on teaching content should be included in the priorities and creation of the proportion of hour's arrangements. D value and T value are smaller projects focused on equipment gymnastic, so the project should be abandoned or as a introduction in the teaching process. T value is larger and D value is smaller only in the project of group calisthenics. This means that the group calisthenics

Makes litter direct contribution, while it has certain support role for other teaching content. So it can be arranged as a general teaching content.

Depends index R in gymnastic teaching content can reflect a reasonable order of teaching content. The smaller the value is the more front opening sequence, conversely the more rearward. R value data statistics of gymnastics teaching content as shown in Table 2.

Table 2- The depends index data table of gymnastic teaching content

Content	A	B	C	D	E	F	G	H	I	G	K	L	M	N
A	8.21	5.33	0.21	0.51	0.81	0.99	2.27	0.89	10.1	7.18	7.04	0.14	7.25	4.56
B	4.33	10.1	3.30	0.40	0.35	0.50	1.98	0.99	5.92	4.02	5.04	0.27	4.93	2.95
C	50.2	5.61	7.44	1.01	1.39	1.49	1.70	1.68	5.24	3.30	4.34	1.23	2.46	2.15
D	0.80	0.42	1.14	7.28	3.00	2.73	2.83	2.37	2.54	2.15	2.11	1.50	1.74	1.61
E	0.68	0.56	1.34	2.63	8.31	4.22	3.68	2.47	2.20	2.01	1.52	1.71	1.45	1.21
F	0.91	0.56	1.03	2.83	4.39	8.93	3.26	2.27	2.71	1.72	1.88	1.09	1.74	1.34
G	2.05	2.38	1.24	2.23	3.12	2.73	10.2	1.78	4.06	4.02	3.75	0.96	3.48	3.35
H	0.68	1.40	1.65	3.24	3.69	3.72	3.40	7.11	3.72	2.59	2.58	1.64	2.61	1.61
I	6.61	1.12	4.75	1.82	2.19	2.23	5.38	2.77	12.1	5.17	5.98	1.43	8.12	4.43
J	5.70	5.33	5.78	0.81	0.92	0.99	5.10	0.99	5.75	10.3	5.51	1.57	6.52	4.69
K	6.84	0.84	5.16	1.82	2.08	3.22	4.39	1.38	8.12	6.61	8.44	0.68	6.96	5.36
L	0.46	0.56	1.24	2.63	3.00	2.98	2.83	2.17	1.86	2.01	1.17	4.92	1.16	0.54
M	5.47	5.47	3.72	1.01	1.04	1.24	4.53	1.88	9.81	7.47	5.86	0.89	10.4	4.56
N	4.33	4.77	2.27	0.81	1.15	1.12	3.26	1.78	7.11	5.74	4.93	0.75	5.51	9.66
R	52.1	44.5	40.3	29.0	35.4	37.1	54.8	30.5	81.4	64.3	60.2	18.8	64.4	48.0

Note: A-N respectively means: queue formation, broad gymnastic, light equipment gymnastic, horizontal bar, horizontal bar, support jump, skill, multifunction devices, aerobics, artistic gymnastic, group callisthenic, rhythmic gymnastic and dance sport

From the data in Table 2 shows that the depends index of teaching content small to large order is:

I<D<H<E<F<C<B<N<A<G<K<J<M<L

Gymnastic Class Project Teaching Design

According the characteristic of gymnastics teaching content and teaching objectives can be achieved degree, the learners of different age groups in accordance with the contents of gymnastics teaching fine learning classes, coarse learning classes, introduces classes and exercise classes to design the gymnastic teaching content, as shown in Table 3.

Table 3- List of teaching content designed for different ages learners

ages	fine learning classes	coarse learning classes	introduces classes	exercise classes
Age: 8 -10	broad gymnastic queue formation skill	dance sport	the knowledge and psychological exercise of horizontal bar and trampoline project	wall bar, light equipment gymnastic, weight, drape, support, roll and other physical exercises
Age: 10 -14	Aerobics eurhythmic skill queue formation	dance sport group calisthenics support jump	introduces the competition rules, exercise prescription knowledge, psychological exercise of uneven bars, pommel horse, rings projects	light equipment gymnastic
Age: 14 -17	Aerobics eurhythmic skill queue formation	dance sport support jump support jump group calisthenics	enjoy gymnastics competition, exercise prescription and psychological training	light equipment gymnastic multifunction devices special body exercise
Age: 17 -21	Aerobics eurhythmic skill dance sport support jump support jump	Aerobics eurhythmic skill dance sport support jump support jump	enjoy gymnastics competition, exercise prescription and psychological training, first aid knowledge, various sports gymnastics principles	dumbbell multifunction devices wall bar special body exercise

Table 3 shows that, 8-10 years old students mainly learn all kinds of basic movement, so that they has little perceptual knowledge for gymnastics class teaching content. It needs to focus on cultivating students' interest in gymnast. The gymnastic class can teach 10-14 years old some of the slightly more complicated action with combination to meet students' curiosity. 14-17 years old high school student can teach something a little more complex actions with a combination of contact, and the need for students to understand the meaning of gymnastics teaching content resides. 17-21 years old college student in gymnastics mainly decided by the students learning electives, so teachers need to meet the different needs of students. The teachers should teach students physical exercise method, and lay the foundation for lifelong physical. Fine learning classes mainly refers the elective content with longer time, while coarse learning class teaching content mainly refers the elective content with shorter time.

CONCLUSION

This research describes the classification and quantification methods of gymnastics class teaching content and teaching objectives. And it analyzes the two associated research objects. After determining the weight of the teaching objectives, it proposed the measure method and of direct contribution value D , total contribution value T ,

dependence index R . Through the scoring of 16 experts draw a data table of direct the contribution value D and total contribution value T , then get the corresponding conclusion through the table. After researching the data tables of R , draw the opening sequence of each teaching content. Gymnastics class project for different age's trainees proposes optimized design, and gives scientific advance.

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