

# Research on the design of sports dance and aesthetic training path for college students in general colleges and universities based on graph theory

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## ABSTRACT

The study is based on the important role of graph theory in the teaching of physical dance and aesthetic education, integrating the concept of graph theory into it and designing the training path of physical dance and aesthetic education based on graph theory. Taking two classes in a university as the research object, the teaching experiment is conducted to compare their physical quality and course performance after the experiment, and the aesthetic education evaluation index system is constructed, and the index weights are measured using the combination assignment method to carry out the comprehensive scoring. After the experiment, the students improved in physical quality, course grades and aesthetic effect, and as far as the students of traditional teaching class are concerned, the experimental students improved in course grades and aesthetic effect by 18.17% and 7.52% respectively. The teaching practice of integrating the concept of graph theory and the curriculum of physical education dance and aesthetic education not only embodies the concept of cross-disciplinary teaching, but more importantly improves the physical quality, physical education dance level and aesthetic effect of students in colleges and universities, and provides a reference for the teaching reform of physical education dance and aesthetic education in colleges and universities.

**Keywords:** graph theory, evaluation index, combination weight, aesthetic evaluation, physical education dance

## 1. Introduction

Sports dance is an important course in school education under the background of quality education, and it is a new type of education program to cultivate students' comprehensive quality. It is a medium-intensity aerobic exercise program, which plays an important role in adjusting students' body shape, enhancing their metabolic ability, preventing arterial paste sclerosis, and strengthening their physical fitness [1-3]. In addition, it is also conducive to regulating emotions and relieving

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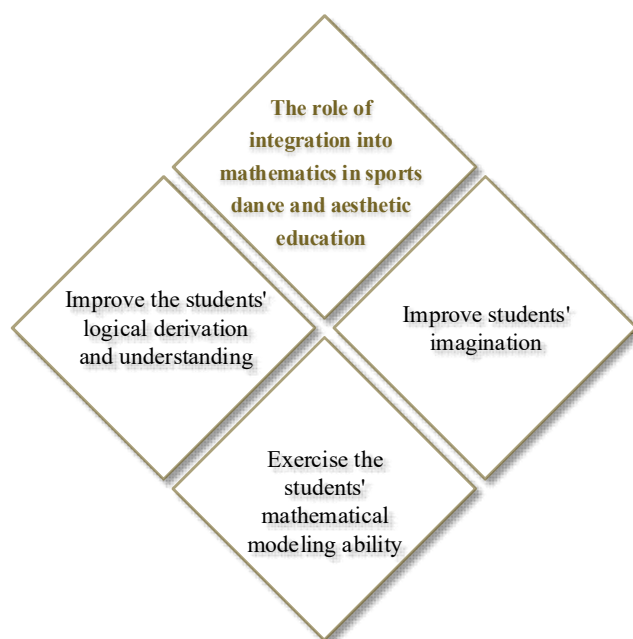
pressure; enhancing students' self-expression and promoting the growth of their self-confidence; exercising students' will and forming good qualities; cultivating students' spirit of solidarity and cooperation, and exercising students' social adaptability [4-7]. Sports dance can cultivate people's aesthetic ability. In the process of learning sports dance, people need to constantly appreciate, feel and understand the beauty of the dance works, so as to improve their aesthetic level, through the appreciation and analysis of the dance works, people can learn different dance styles, dance techniques and dance expression methods, so as to expand their aesthetic vision and improve their aesthetic ability [8].

The more civilized society is, the higher the pursuit of beauty is, the more aesthetic education has won its rightful place. Aesthetic education is to cultivate students' ability to feel, express, appreciate and create beauty, thus prompting students to pursue the interest of life and ideal world as the goal of education [9]. Aesthetic education, art, music, literature, dance, theater and other art forms as a means of using educational methods, for young children, students and youth to carry out systematic art education and training. It fosters students' ability to discover, appreciate and create beauty; improves students' humanistic qualities and sense of social responsibility; enhances students' teamwork spirit and creativity; promotes students' all-around development, and lays the foundation for students' lifelong learning [10-13]. This not only improves students' literacy in art, music, dance and drama, but also stimulates creativity and imagination, cultivates aesthetic ability and positive attitudes and values, improves cultural quality and quality of life, and makes them more powerful and comprehensive and broader space for development [14-17]. Aesthetic education is of great significance and value in today's society and plays a positive role in promoting the development of individuals and society. Sports dance plays an important role in improving the aesthetic interest of college students and realizing the cultivation of personality and humanity. As an important carrier of aesthetic education [18], the role of sports dance in the dissemination of aesthetic education has also become more and more prominent. Aesthetic education and physical education dance complement each other, and play an important role in cultivating students' personality perfection and integrity.

This paper describes the important role of integrating graph theory in the teaching of sport dance. On this basis, the design of the training path between physical dance and aesthetic education is accomplished through the creative penetration of graph theory, optimization of curriculum, enrichment of artistic practice and focus on humanistic education in the teaching of physical dance and aesthetic education. Two physical dance and aesthetics courses classes of 2023 in a university were selected as experimental subjects, and the physical fitness level of students was assessed from three indexes of 1000m, 8000m and seated forward bending before and after the experiment, and physical education courses and aesthetics courses tests were carried out. At the same time, from the three dimensions of aesthetic literacy, humanistic literacy and professional literacy, the evaluation index system of students' aesthetic education was established, and the weight optimization model based on subjective and objective comprehensive assignment was used to assign weights, so that the comprehensive scores of students' aesthetic education in the two classes were measured. Through the comparison of students' experimental results in the three dimensions of physical quality, course performance and aesthetic evaluation, the teaching effect of the graph theory-based training path of physical dance and aesthetic education is explored.

## **2. The role of integrating graph theory in sport dance and aesthetic education**

Incorporating graph theory knowledge in the physical education dance and aesthetic education classroom in general colleges and universities is a link to incorporating abstraction, computation and logical reasoning, and spatial imagination into dance, and its existence as a natural discipline is of great significance. The role of incorporating graph theory in physical dance and aesthetic education is shown in Figure 1.



**Fig. 1.** The role of integration into mathematics in sports dance and aesthetic education

### 2.1. *Enrichment of imagination*

When practicing sports dance and aesthetics training, changes in sports dance formations are closely related to geometric shapes in graph theory, which requires students to give full play to their imagination to organize and design. In the process of practicing sports dance in order to better express the sense of beauty, the use of irregular shapes is more common, such as squares, circles and diamonds. A variety of dance transformations add a good performance effect to the dance performance.

### 2.2. *Exercise of spatial skills*

Through the teaching of physical dance and aesthetics, students can better utilize the design of space and the distribution of positions. The relationship between the rating of an excellent dance and the goodness of the dance is very close. Most of the positions and spaces in dance practice are three-dimensional, which corresponds exactly to the right-angle coordinate system in graph theory. In dance practice the hands are spread out to represent the X-axis, the body is built up as part of the Z-axis, and at the beginning of the dance the orientation around oneself is divided into eight different positional spaces. No matter where you move to, you will find the corresponding position in the spatial coordinates, and thus find a good positioning for your exact position.

### 2.3. *Improved understanding of derivation*

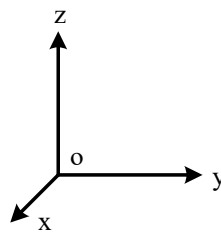
Utilizing a lot of graph theory thinking exercise can make students think more clearly when dealing with sports dance problems, stable and orderly operation of all matters. The learning process of sports dance is relatively complex, such as in the process of practicing to go to memorize a large number of movements and positions, changes in formation, expression of emotions, performance style, etc., which puts requirements on students' comprehension and deduction ability, and this kind of learning process is exactly the embodiment of logical deduction and comprehension, which is very important in the knowledge of graph theory.

### 3. A training path for physical dance and aesthetics based on graph theory

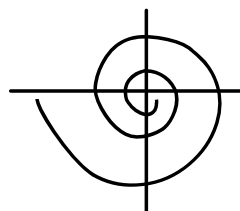
Incorporating graph theory knowledge into the teaching of physical education dance and aesthetic education for college students in general colleges and universities can better promote the development of physical education dance and aesthetic education programs. Graph theory takes the graph as the research object, which is a graph composed of a number of given points and a line connecting the two points, and is usually used to describe a particular relationship between certain things. This paper integrates graph theory with the teaching of physical education dance and aesthetic education, and the following is the training path of physical education dance and aesthetic education based on graph theory.

#### 3.1. *The fusion penetration of graph theory*

3.1.1. **Precise focusing of space geometry.** In the teaching of sports dance and aesthetic education, it often involves the identification and transformation of three-dimensional orientation, so that all parts of the body point to a clear position, and the knowledge of graph theory can be used to accurately focus on the direction of dance. First, the dance sport can be accurately positioned through a spatial Cartesian coordinate system. As shown in Figure 2, the spatial Cartesian coordinate system is established with the straight line of the coordinate system "front and back" as the x-axis, the straight line of the coordinate system "left and right" as the y-axis, and the straight line of the coordinate system "up and down" as the z-axis. In other words, when college students establish an appropriate spatial Cartesian coordinate system with the body as the center point, the dance movements can be accurately gathered and quantified. Second, another commonly used is the polar coordinate system, the equiangular spiral in the polar coordinate system is praised as the "golden spiral", the equiangular spiral is shown in Figure 3, which follows the golden law everywhere, such as the golden section point, the golden ratio, the golden rectangle, etc. In summary, sports dance movements can accurately focus dance movements according to the principle of Cartesian coordinate system and polar coordinate system.



**Fig. 2.** Rectangular coordinate system



**Fig. 3.** Isometric spiral

However, the application of graph theory in sports dance and aesthetics includes not only three-dimensional spatial dimensions, but also multi-dimensional geometric shapes. Dance formations rely on graphic changes in their variation process, and in order to emphasize the overall

beauty of the dance, dance formations often apply geometric shapes, as well as many seemingly irregular but coordinated shapes. Such as squares, rectangles, polygons and straight and diagonal lines of interlocking geometric shapes, or external irregular and internal rules of the graphics. In addition, the composition of the dance screen in the stage in line with the law of golden section, equilateral triangle, isosceles trapezoid, circle, rhombus and other shapes of the axis of symmetry and straight line will be divided into two parts of the stage, the ratio of the area is equal to the ratio of the golden section is optimal, the golden section, such as the golden section as shown in Figure 4. The use of multi-dimensional three-dimensional graph theory principles, focus and analyze the richness, complexity and regularity of the dance action space, dance formations of the transformation of the dance repertoire performance has the role of the finishing touch, and beautiful dance formations can not be presented without the intervention of the spatial dimensions and geometric principles.

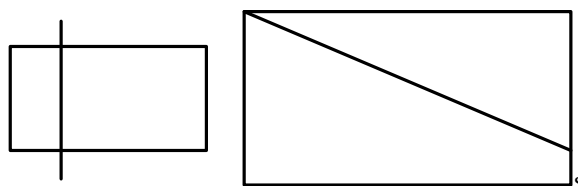


Fig. 4. Golden ratio

3.1.2. *Ontological configuration of the dance repertoire.* The ontological configuration of the sports dance program takes points, lines, surfaces, spaces, shapes and other elements in graph theory as its elements, and after combining and arranging various elements, it is transformed into every frame of action in the dance program in a certain trajectory and movement way. In the dance genre, no matter classical dance, folk dance, modern dance or contemporary dance, we can try to use the geometric principle of graph theory to precisely analyze the dance spatial configuration, so that the dance works can create a unique and infectious dance mood under the control of symmetry and balance, simplicity and unity, and harmony and contrast and other laws of form and beauty. As a result, the picture form in the dance drama is completed through the composition, and the creators need to rely on the knowledge and interpretation of the play itself, and rely on the knowledge of mathematical and theoretical graph theory to shape the characters, images, and movements in an exquisite way.

### 3.2. *Enhancement of artistic expression*

3.2.1. *Optimizing the curriculum.* Colleges and universities should build a scientific and systematic curriculum system for the characteristics of sports dance and aesthetic education. In the curriculum, not only should the basic training be strengthened, including body flexibility, strength, coordination and other aspects of the training, but also increase the number of dance theory, dance appreciation and other related courses, in order to broaden the students' artistic horizons, and improve their artistic literacy and aesthetic ability.

3.2.2. *Enrichment of artistic practices.* Colleges and universities should actively organize various kinds of dance competitions, exhibitions and other activities to provide students with more practical opportunities. At the same time, professional dancers, choreographers and other people can be invited to schools to hold lectures, workshops and other activities, so that students can communicate and learn face-to-face with professionals and further improve their artistic quality and performance level.

3.2.3. *Focus on humanistic education.* Humanistic literacy is the soul of aesthetic teaching, only with a deep humanistic heritage can we convey deep cultural connotations and emotions in sports

dance. Colleges and universities should pay attention to the humanistic education of students in sports dance and aesthetic training. Through opening cultural courses, organizing cultural lectures and other ways, students can be guided to extensively explore all kinds of cultural knowledge to improve their cultural taste and aesthetic interest.

#### 4. Experiments in teaching physical dance and aesthetic education

##### 4.1. Subjects of study

In this paper, according to the training path of physical dance and aesthetic education based on graph theory, the teaching practice of physical dance and aesthetic education option class of 2023 in a general college was selected as the research object, with a total of 50 students, divided into experimental class (Class 1) and control class (Class 2), and the levels of physical dance and aesthetic education of the two classes were comparable, with 25 students each in each class.

##### 4.2. Study design

Two classes of 50 college students (all of whom had taken one semester of physical dance and aesthetics courses) were tested on the “Viennese Waltz” combination using a scoring system, and the physical fitness of the students in the two classes was also tested, resulting in the pre-test scores, which were used to conduct an independent samples t-test to test the difference values between the two groups. Class 1 was taught with a graph theory-based training pathway for physical dance and aesthetic education, while Class 2 was taught with a traditional teaching model, and the rest was basically the same.

This paper evaluates the effectiveness of the teaching experiment through three dimensions: physical dance and aesthetic education course performance, students' physical fitness, and students' aesthetic education effect. The first two are collected through the test, and the students' aesthetic effect requires the construction of aesthetic evaluation indexes, and the weight optimization model of subjective and objective comprehensive assignment is used for the calculation of index weights.

##### 4.3. Evaluation index system for aesthetic education

In the sports dance and aesthetic option class, the evaluation index system of students' aesthetic education is required to reflect the difference with other disciplines and the unique characteristics and functions of their own programs, and to clearly determine the evaluation based on learning, so as to give play to the fitness of physical education to educate people and the aesthetic education to moisten the mind, to strengthen the integration of physical education and aesthetic education, and to promote the all-around development of the students. According to the modification opinions of the experts, a new round of evaluation index system of students' aesthetic education in physical education, dance and aesthetic option courses of general colleges and universities was constructed after adjusting the preliminary indicators, and the evaluation index system of students' aesthetic education was shown in Table 1, and 3 first-level indexes, 8 second-level indexes and 32 third-level indexes were determined in the end.

**Table 1.** The evaluation index system of student aesthetic education

| Primary indicator           | Secondary indicator      | Tertiary index                                    |
|-----------------------------|--------------------------|---------------------------------------------------|
| Aesthetic accomplishment A1 | Aesthetic reading A11    | The aesthetic sense of different dances A21       |
|                             |                          | Feedback on different dancing music festivals A22 |
|                             | Aesthetic experience A12 | The evaluation of sports dance art works A23      |
|                             |                          | Exercise appreciation A24                         |
|                             |                          | Aesthetic evaluation ability A25                  |

|                       |                         |                                                         |
|-----------------------|-------------------------|---------------------------------------------------------|
|                       | Aesthetic creation A13  | Cross thinking A26                                      |
|                       |                         | Beautify oneself A27                                    |
|                       |                         | The aesthetic performance of exercise A28               |
|                       |                         | Learn about sports dance information A29                |
|                       |                         | Active participation in extracurricular activities A210 |
|                       |                         | Independent creation of dance fragments A211            |
| Humanistic quality A2 | Humanistic spirit A14   | Dance etiquette A212                                    |
|                       |                         | Game view A213                                          |
|                       |                         | Rule consciousness A214                                 |
|                       |                         | Team consciousness A215                                 |
|                       | Humanistic ability A15  | Confidence A216                                         |
|                       |                         | Will power A217                                         |
|                       |                         | Pressure resistance A218                                |
|                       |                         | Organizational ability A219                             |
|                       |                         | Social adaptability A220                                |
|                       |                         |                                                         |
| Professionalism A3    | Special quality A16     | Physical posture A221                                   |
|                       |                         | Line and ductility A222                                 |
|                       |                         | Coordination A223                                       |
|                       |                         | Special flexibility A224                                |
|                       | Basic skill A17         | Action quality A225                                     |
|                       |                         | The grip of the dance A226                              |
|                       |                         | Mating partner A227                                     |
|                       |                         | Choreography and presentation A228                      |
|                       | Artistic expression A18 | Rhythm and beat A229                                    |
|                       |                         | Facial expression A230                                  |
|                       |                         | Dress collocation A231                                  |
|                       |                         | Design of shape A232                                    |

#### 4.4. Weight Optimization Model

4.4.1. Combined weights model. The establishment of the combination weight model is mainly divided into two parts, first of all, the construction of the subjective weight combination model of multi-expert subjective weight, the construction of the model is: by  $N_o$  expert using fuzzy hierarchical analysis to judge the  $N_i$  indicators to obtain the subjective weight  $w_i, i=1,2,\dots,N_o, w_i = w_y, j=1,2,\dots,N_1$ , if the combination of weight coefficients obtained by solving for the combination of weights for the  $k_i, i=1,2,\dots,N_o$ , the combination of weights for the  $W$ :

$$W = k_1 w_1 + k_2 w_2 + \dots + k_{N_o} w_{N_o} = \sum_{i=1}^{N_o} k_i w_i \quad (1)$$

#### 4.4.2. Single-objective optimization models:

1) Combined coefficient uncertainty function. For the quantitative description of the combined coefficient uncertainty, information entropy is used to quantify the uncertainty magnitude and the uncertainty objective function is as follows:

$$\max H(\vec{k}) = -\sum_{i=1}^{N_o} k_i \ln(k_i) \quad (2)$$

where  $N_o$  is the number of experts and  $\vec{k} = (k_1, k_2, \dots, k_{N_o})$ .

2) Weight vector consistency function. Combination of weights and their components should have overall consistency, using the distance to indicate the size of consistency, the larger the distance is the worse the consistency, so the consistency of the construction of the objective function is as follows:

$$\min F(\vec{k}) = \sum_{j=1}^{N_1} \sum_{i=1}^{N_0} (W_j - w_{ij})^2 \quad (3)$$

where  $N_0$  is the total number of experts in the combined INS/GNSS navigation system,  $N_1$  is the number of evaluation indicators,  $W_j$  is the  $j$ th component of the combined weights, and  $w_i$  is the  $j$ th component of the  $i$ th expert weight.

3) Constraint Function. The combination weight factor  $\vec{k} = (k_1, k_2, \dots, k_{N_0})$  is obtained by solving  $H(\vec{k})$  and  $F(\vec{k})$  above, and the maximization solution problem of  $H(\vec{k})$  is converted into a minimization problem, then the combination weight factor solution formula is as follows:

$$\min h(\vec{k}) = \alpha H(\vec{k}) + \beta F(\vec{k}) \quad (4)$$

$\alpha$  and  $\beta$  are the combination coefficients of uncertainty coefficient and consistency coefficient, after many experiments, it is known that the values of  $\alpha$  and  $\beta$  have very little influence on the final experimental results, so we can set  $\alpha = \beta = 0.5$  and  $h(\vec{k})$  as the combination weight coefficients.

Combination weight coefficient  $\vec{k} = (k_1, k_2, \dots, k_{N_0})$  is the normalization coefficient used to weight and solve the combination weight, so it needs to meet the following requirements:

$$h(\vec{k}) = \sum_{i=1}^{N_0} k_i = 1, 0 \leq k_i \leq 1 \quad (5)$$

4) Subjective and objective weights fusion. After the completion of the subjective weight single-objective model, it is necessary to use the objectivity of the objective weights to adjust the subjective weights in order to achieve the combination of subjective and objective weights, the correction formula is as follows:

$$w'_i = \eta_i w_i / \sum_{i=1}^n \eta_i w_i \quad (6)$$

where  $\eta_i, i=1, 2, \dots, N_1$  is the objective weight,  $w_i, i=1, 2, \dots, N_1$  is the subjective weight, while  $w'_i, i=1, 2, \dots, N_1$  is the subjective-objective fusion weight and  $N_1$  is the number of evaluation indicators.

## 5. Results and analysis of teaching effectiveness

### 5.1. Comparison of physical fitness

At the end of the teaching experiment, the three physical fitness indicators, namely, seated forward bending, 800-meter run (female) and 1000-meter run (male), were tested twice, and the data scores were analyzed by t-test. The average physical fitness test statistics of students after the experiment are shown in Figure 5. The P-values of the three index points of seated forward bending, 800-meter running (female), and 1000-meter running (male) are 0.183, 0.395, and 0.226 respectively, and the P-values are all  $> 0.05$ , which indicates that there is no significant difference in the data of physical fitness of the two groups of students after the teaching experiment. The test results of the two

classes in the three indicators were 13.85cm and 12.77cm, 243.78s and 241.38s, 253.92s and 254.63s, respectively, which showed that the physical fitness of Class 1 students improved after the teaching experiment of Physical Dance and Aesthetic Education. It shows that the training path of physical dance and aesthetic education based on graph theory has a positive effect on improving students' physical fitness.

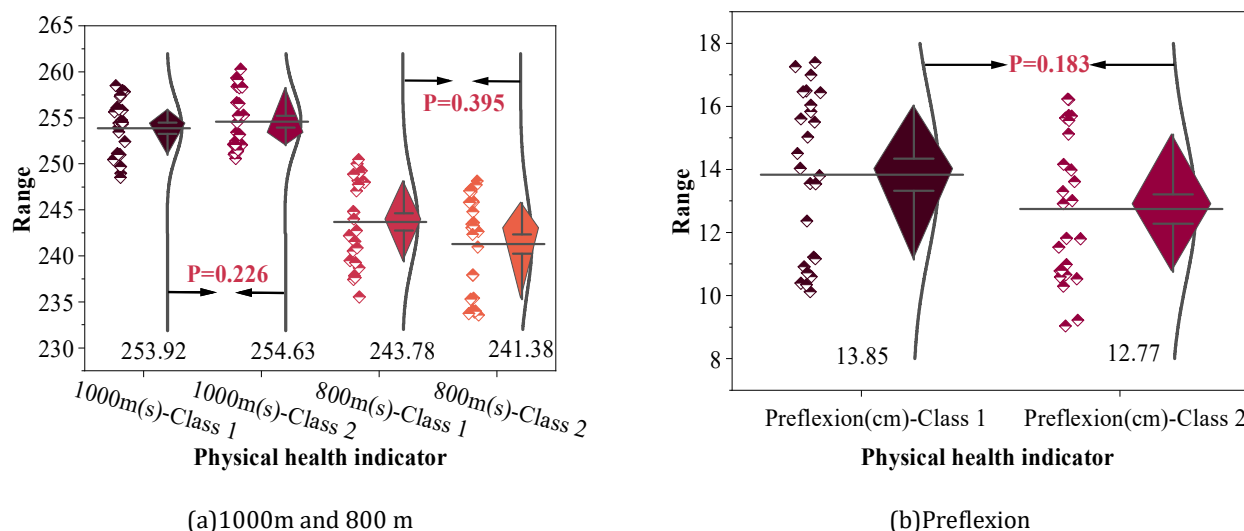


Fig. 5. Students' average physical quality test statistics after experience

## 5.2. Comparison of course grades

1) Comparison and analysis of average scores. After the experiment, Class 1 and Class 2 were subjected to a physical dance skills test, which consisted of a single waltz basic step as well as a duo presentation waltz bronze combination based on technical quality (TQ), movement musicality (MM), ensemble skill (PS), and choreography and presentation (CP), and each student's individual score was calculated separately by the results of the test from 10 raters. Class 1 and Class 2 were ranked in order of numbers, with each program scoring 10 and a combined score of 40.

Comparison of the average scores of various indexes of sports dance is shown in Figure 6. The scores of various indexes of Class 1 are above 8.3, and the scores of various indexes of Class 2 are significantly lower than those of Class 1 after the experiment. The overall scores of the test scores of the two classes of Sports Dance and Aesthetics are 8.39 and 7.10, respectively. After adopting the training path of the Sports Dance and Aesthetics based on the Graph Theory, Class 1's Sports Dance and Aesthetic Education course scores were 18.17% higher.

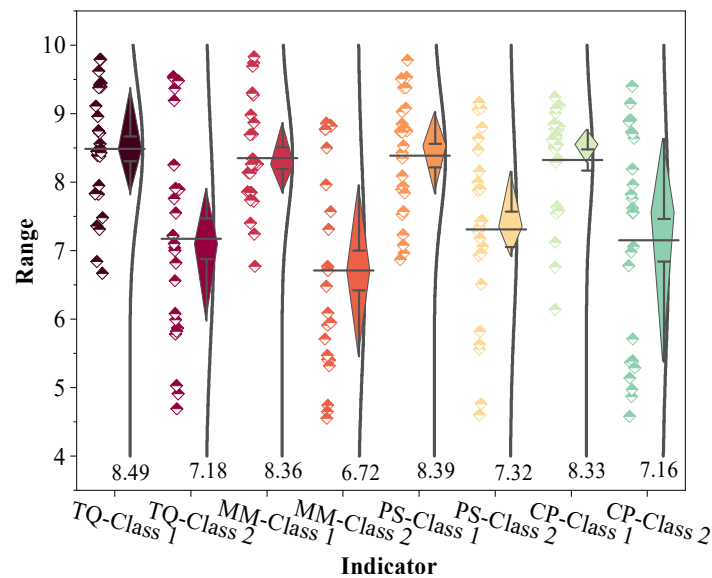


Fig. 6. Comparison of the average performance of sports dance indicators

2) Independent samples T-test. The test data of two classes before and after the experiment and two classes after the experiment were subjected to independent samples T-test, and the results of the independent samples T-test are shown in Table 2. The  $P=0.006<0.01$  of the scores before and after the experiment of Class 1 and the difference between the two is very large, which indicates that the performance of physical dance in Class 1 is very different compared with that before the experiment. Through comparative analysis, it was found that Class 1's scores in each of the post-experiment were better than those in the pre-experiment, which led to the conclusion that Class 1's performance in physical dance improved by 21.07% compared to that at the beginning of the semester after one semester of course teaching based on the graph theory's pathway of physical dance and aesthetics training.

$P=0.073 > 0.01$  before and after the experiment for Class 2. The physical dance and aesthetics scores of this class were improved after the experiment, but there was no significant difference.  $P=0.003<0.01$  of independent samples t-test of two classes after the experiment shows that there is a big difference between the physical dance and aesthetic performance of the two classes, and the performance of Class 1 is significantly higher than that of Class 2. It shows that the improvement of technical ability of physical dance under the teaching mode of this paper is more than that under the traditional teaching mode, and the level of physical dance skills rises more quickly.

Table 2. Independent sample t test results

|         |      | Before  | After   | t     | p     |
|---------|------|---------|---------|-------|-------|
| Class 1 | Mean | 6.93    | 8.39    | -3.27 | 0.006 |
|         | SD   | 0.48    | 0.33    |       |       |
| Class 2 | Mean | 6.98    | 7.10    | -4.81 | 0.073 |
|         | SD   | 0.45    | 0.41    |       |       |
|         |      | Class 1 | Class 2 | t     | p     |
| Score   | Mean | 8.39    | 7.10    | -3.46 | 0.003 |
|         | SD   | 0.33    | 0.41    |       |       |

### 5.3. Evaluation and analysis of aesthetic education

5.3.1. Indicator weights. Through the weight optimization model based on subjective and objective comprehensive assignment, the weights of the indicators are calculated, and finally the weights of the students' aesthetic evaluation indicators of the sports dance and aesthetic option class are obtained. The weights of the primary and secondary indicators of students' aesthetic evaluation are shown in Figure 7, and the weights of the tertiary indicators of students' aesthetic evaluation are shown in Figure 8. In the evaluation index system of students' aesthetic education in physical education dance option class, the first-level index aesthetic literacy A1 (0.3862) > humanistic literacy A2 (0.3113) > professional quality A3 (0.3025). The second-level indicators humanistic ability A15 (0.1624) > aesthetic experience A12 (0.1592) > humanistic spirit A14 (0.1487) > aesthetic creativity A13 (0.1404) > basic skills A17 (0.1078) > specialized qualities A16 (0.1023) > artistic expression A18 (0.0924) > aesthetic concepts A11 (0.0866). Among the three-level indicators, team awareness A215 (0.0486), stress resistance A218 (0.0463), and dance etiquette A212 (0.0451) have the greatest weights.

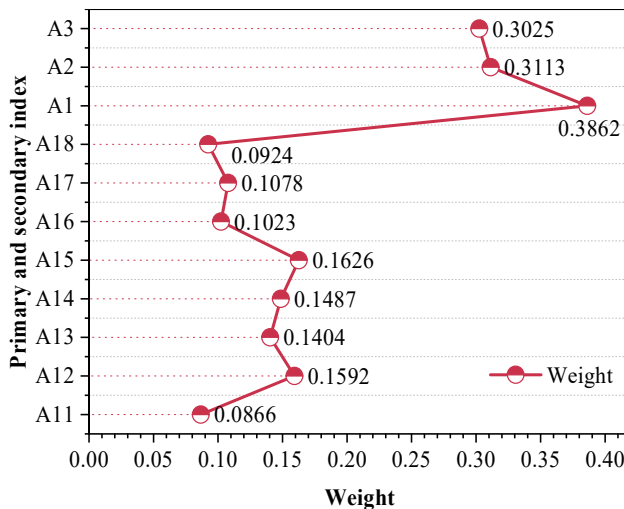
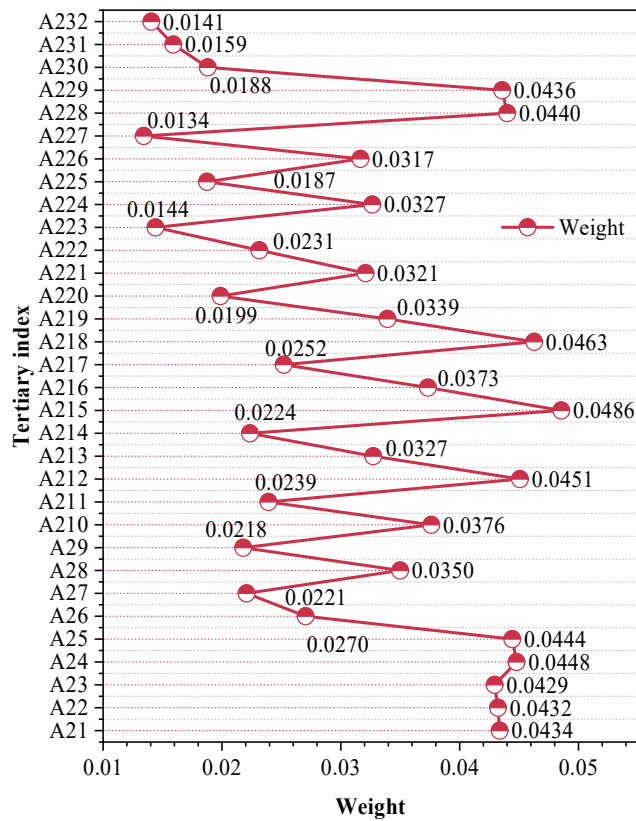


Fig. 7. The primary and secondary index weights of student aesthetic evaluation



**Fig. 8.** The tertiary index weight of student aesthetic evaluation

5.3.2. Evaluation results. The data are weighted according to the weights of each indicator obtained above, and the weighted scores of the 36 third-level indicators are summed to get the comprehensive score of college students' aesthetic education evaluation. The results of the students' aesthetic evaluation scores of the two classes are shown in Fig. 9. The results of the students' aesthetic evaluation scores of Class 1 and Class 2 are 8.15 and 7.58 respectively, and the evaluation results of Class 1 students are improved by 7.52% compared with those of Class 2 students, which indicates that after the teaching of sports dance and aesthetic training pathway based on the graph theory, the effect of the teaching of aesthetic education of Class 1 students is improved. Improvement. Among them, Class 1 students had the highest evaluation scores on Aesthetic Concept A11 and Aesthetic Creation A13, with ratings above 9 points.

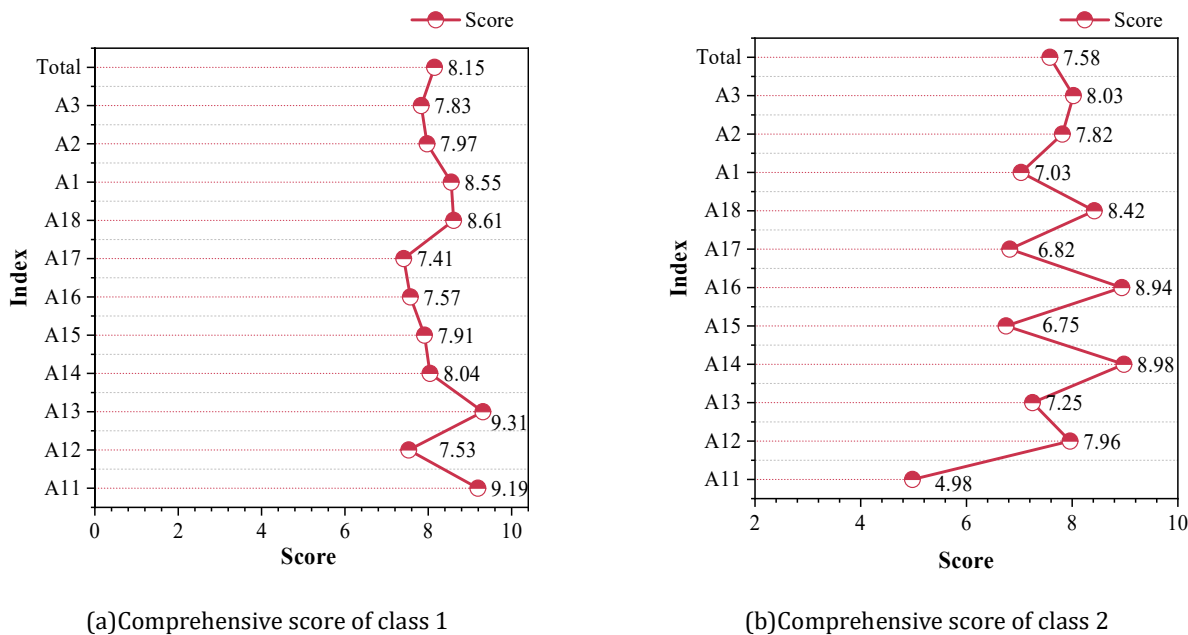


Fig. 9. Evaluation scores of the students' aesthetic education

## 6. Conclusion

Sports dance and aesthetic training for college students is a systematic project. This project introduces the concept of graph theory into the teaching of sports dance and aesthetic education, and proposes a training path for this course. Based on this path, a teaching experiment is designed to investigate the application effect of the proposed path in three dimensions: physical quality, course performance and aesthetic evaluation.

1) The training path based on graph theory in this paper has a certain effect on improving students' physical quality, and the results of the test indexes of the experimental students are all higher than those of the students in the class of traditional teaching, but there is no significant difference between the two classes ( $p > 0.05$ ). In terms of the performance of physical education dance and aesthetics courses, there is a significant difference between the results of the two classes after the experiment at the level of 1%, and the results of the experimental students have been improved by 21.07% compared with the preexperimental period and by 18.17% compared with the students of the class of traditional teaching. It reflects the positive effect of the graph theory-based training path of physical dance and aesthetics on students' physical fitness and physical dance learning.

2) The results of students' aesthetic education scores in the two classes are 8.15 and 7.58, and the experimental students' aesthetic education level is 7.52% higher than that of the students in the traditional teaching class, especially in terms of aesthetic concepts and aesthetic creativity, which corroborates the effect of this paper's graph-theory based training path on the aesthetic education of college students.

Applying the concept of graph theory, optimizing the curriculum, enriching artistic practice and focusing on humanistic education are effective ways of sports dance and aesthetic education. These measures not only help to improve students' dance skills and performance level, but also can enhance students' aesthetic education effect and promote students' overall physical development. Looking ahead, with the growing demand for sports dance talents in the society, sports dance teaching in colleges and universities should pay more attention to the cultivation of aesthetic education, innovate teaching methods and means, adapt to the demand for talents in the new era,

and contribute to the comprehensive development of students as well as the inheritance of the art of dance.

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