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Research on Multi-Objective Planning and Constraints of Cross-border Compound Music Talent Cultivation Mode in Higher Vocational Colleges Driven by Quality Improvement and Excellence Training

Xinli Han[1,] ✉

[1] *Academy of Music, Henan Polytechnic, Zhengzhou, Henan, 450046, China*

ABSTRACT

The purpose of this study is to evaluate the comprehensive ability of students objectively by constructing the evaluation system of compound music talents based on multi-objective planning, so as to promote the quality improvement and excellent cultivation of compound music talents in higher vocational colleges. The selected evaluation indexes of composite music talent cultivation are empowered by using the combination assignment method, and the construction of multi-objective planning model for cross-border composite music talent cultivation is realized based on the setting of objective function, constraints and model solving method. The article forms an index system covering 6 dimensions and 24 indicators, successfully divides the interval length of five evaluation levels, and obtains the distribution of students in each level, with the largest proportion of students in level 3, which is 40.77%. In addition, the ratings of the level 1 indicators are 2.47 to 3.31, which are in the middle to lower level. According to the student groups of different grades and the evaluation results of the indicators, we can clarify the level of student cultivation, improve the music talent cultivation system, coordinate and improve the elements and resources of each dimension, and promote the cultivation of cross-boundary composite music talents in higher vocational colleges and universities.

Keywords: multi-objective planning, constraints, combination empowerment, evaluation system, music talent cultivation model

1. Introduction

With the rapid development of the economy and the continuous progress of science and technology, more and more enterprises and social organizations are inclined to recruit multidisciplinary music talents with multiple abilities and specialties, which puts forward brand-new requirements for higher

✉ Corresponding author.
E-mail address: 18838957389@163.com (X. Han).
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vocational education. Higher vocational colleges and universities need to explore and innovate the music talent cultivation mode, and gradually build a composite music talent cultivation mode adapted to the needs of the society [1-4]. Therefore, it is of great significance to study the multi-objective planning and constraints of the cross-border composite music talent cultivation mode of higher vocational colleges and universities under the drive of improving quality and cultivating excellence.

The innovation of higher vocational cross-disciplinary composite music talent cultivation mode needs to make breakthroughs in the following aspects. Innovative curriculum. The traditional curriculum of higher vocational colleges and universities is usually divided according to specialties, and students receive the knowledge and skill training of a single specialty during their school years. Nowadays, the demand for music talents in society is more interdisciplinary, requiring students to have knowledge and skills in various aspects [5-8]. Higher vocational colleges and universities need to re-examine the curriculum, integrate the courses of different majors, and design some courses with interdisciplinary characteristics, so that students can be exposed to the knowledge of other professional fields while cultivating their own professional skills, and improve the comprehensive quality of students [9-12]. Innovative teaching methods. Traditional teaching methods are mainly based on classroom lectures and laboratory teaching, and students receive the knowledge and skills taught by the teacher. This kind of teaching method easily leads to students' thinking limited to their own specialty, and it is difficult to think and solve problems across specialties [13-16]. Higher vocational colleges and universities need to innovate teaching methods, adopt project-driven, practical teaching and other methods, so that students can be exposed to interdisciplinary problems in actual operation, and cultivate their comprehensive problem-solving ability [17-19]. The practice of inter-disciplinary composite music talent cultivation mode in higher vocational colleges and universities needs to be implemented in the school management system, the construction of faculty, the construction of practice bases and other aspects [20-21].

The study selects evaluation indexes for the quality of compound music talent cultivation from six dimensions based on the music talent cultivation demand of improving quality and cultivating excellence. The method of subjective and objective assignment is used to complete the assignment of indicators, the subjective assignment is determined by the improved G2 method, and the objective assignment is determined by the projection tracing method optimized by accelerated genetic algorithm. The objective function and constraints are designed according to the selected indicators, and the multi-objective planning model based on the cultivation of compound music talents is constructed by calculating and solving with the help of traversal algorithm. On this basis, data are collected from teachers and students of several colleges and universities in Q city through questionnaires, and the numerical intervals of the model hierarchy are solved by substituting empirical data, and the evaluation scores are calculated for the first-level indexes and second-level indexes of the samples. Finally, the hierarchical structure of the cross-border composite music talent cultivation model including four levels is constructed, and the development suggestions of the composite music talent cultivation model are given from the three dimensions of clarifying the cultivation level, perfecting the cultivation system and rationally utilizing the resources.

2. Multi-objective planning model for the cultivation of composite music talents

Compound music talents are those who have solid professional foundation, wide knowledge and strong ability. Composite music talents of industrial analysis and inspection not only need to be proficient in the professional knowledge and professional skills required for analysis and testing positions, have certain core abilities such as organization and coordination, laboratory management, but also have high professional quality and professional ethics. In order to objectively evaluate the training quality of compound talents and improve the quality of talent training, the school constructs and explores the evaluation system of compound music talents from the aspects of course learning quality and enterprise internship appraisal according to the learning and growth process of students.

At present, the social economy is in a critical period of transformation to high-quality development and industrial upgrading, the requirements for the quality of music talents are getting higher and higher, and a large number of high-quality composite music talents are needed under the drive of improving quality and cultivating excellence. As a result, this chapter constructs a multi-objective planning model of cross-border composite talent cultivation mode in higher vocational colleges and universities, and determines the idiosyncratic guiding role of each element on the cultivation of cross-border composite music talents by evaluating the quality of cross-border composite music talent cultivation, so as to achieve the purpose of constructing cross-border composite music talent cultivation mode in a scientific and precise way.

2.1. Selection of indicators

The establishment of an effective model for the cultivation of composite skilled music talents is an important task for the reform and development of the music talent cultivation model of higher vocational colleges and universities. Composite music talents refer to those who have the basic knowledge and basic skills of two or more specialties, with higher comprehensive quality and more comprehensive development.

On the basis of analyzing the research literature on the evaluation indexes of related talent cultivation mode and the practice of cultivating compound music talents in existing higher vocational colleges and universities, the evaluation indexes of compound talent cultivation mode are selected through expert interviews, and the evaluation index system of higher vocational compound music talent cultivation mode is finally determined, and the evaluation system of cross-border compound music talent cultivation mode is shown in Table 1. There are 6 first-level indicators and 24 second-level indicators, covering different aspects of the senior cross-border composite music talent cultivation mode, fully reflecting the characteristics of the senior composite music talent cultivation mode.

Table 1. The multi-boundary complex talent training mode evaluation system

Primary indicator	Symbol	Secondary indicator	Symbol
Professional orientation	A1	Student training orientation	B1
		Student training goals	B2
		Student training standards	B3
		Subject characteristics	B4
Foster quality assurance and supervision	A2	Cross-professional resource sharing	B5
		School and enterprise resource sharing	B6
		Evaluation of training effect	B7
		Foster quality supervision	B8
Teacher ability	A3	Teaching ability	B9
		Teacher structure	B10
		Teaching method	B11
		Assessment mode	B12
Course resources	A4	Course content	B13
		Course structure	B14
		Course practice conditions	B15
		Effect of course practice	B16
Teaching effect	A5	Mastery of composite knowledge	B17
		Improved composite skills	B18
		Improved vocational quality	B19
School cooperation	A6	Student internship	B20
		The design of the music talent scheme involved in the enterprise	B21
		Teachers participate in research and production of enterprises	B22
		Part-time teachers enter the classroom	B23
		Companies provide funding for schools	B24

2.2. Combinatorial assignment methods

In this paper, in the assignment of indicators of the quality of cross-border composite music talent cultivation, the improved G2 method is selected to determine the subjective weights of the indicators, and the projection seeking model optimized by accelerated genetic algorithm (RAGA-PP) is selected to determine the objective weights of the indicators, which is further combined with the combination assignment method to calculate the combination weights.

2.2.1. Improvement of the G2 method. First, the set of evaluation indicators is defined as $X = \{X_1, X_2, ..., X_n\}$, where n indicates the number of indicators, the expert selects an unimportant indicator from the indicators and takes it as a reference, which is recorded as X_a. The ratio of the Gini coefficient of the rest of the indicators to that of X_a is calculated to determine the degree of importance of each indicator, and finally, the value of the weight of the indicators is obtained. The specific calculation steps are as follows:

1) Calculate the value of the Gini coefficient of the indicators. Rearrange all evaluation indicators and calculate the Gini coefficient value of each evaluation indicator G_i:

$$G_i = \frac{1}{mY_i} \sum_{p=1q=p+1}^{m-1} | y_{ip} - y_{iq} | \tag{1}$$

Where: m denotes the number of samples, y_{ip} and y_{iq} denote the value of the indicator X_i

corresponding to the p,q th sample, respectively, and Y_i denotes the sum of the values of the m samples for X_i.

2) Calculation of the degree of importance of indicators. Based on the least important indicator selected by the experts from the indicators is recorded as X_a and the relative importance r_i of the other indicators is calculated:

$$r_i = \frac{G_i}{G_a} \tag{2}$$

Where: G_a represents the Gini coefficient value for indicator X_a.

3) Calculate the subjective weight of the indicator:

$$w_i = \frac{r_i}{\sum_{i=1}^{n} r_i} \tag{3}$$

2.2.2. RAGA-PP method. Accelerated genetic algorithm (GA) is realized on the basis of biological evolution theory, population evolution theory and other theories, the algorithm is a kind of search algorithm that simulates the process of biological genetic evolution, in nature, in the process of genetic iteration again and again, through the individuals constantly select, crossover and mutation and other operations, to select the individual with the highest degree of fitness, and constantly repeat this operation, to select the optimal individual, genetic algorithms will be used in nature in biological evolution for solving practical decision-making problems, through the precise search of large-scale populations to constantly evolve to the optimal solution, the method has the characteristics of objectivity and so on. Genetic algorithms use biological evolution in nature to solve practical decision-making problems, through the precise search of a large range of populations, and constantly evolve to the optimal solution, which has the characteristics of objectivity and so on. Therefore, this paper combines the accelerated genetic algorithm and the projection tracing method, and uses the genetic algorithm to solve the optimal solution in the projection tracing model, find the optimal projection direction, and get the weight values.

1) Indicator data standardization. Standardize the indicator data to facilitate uniform calculation. Mark the j nd indicator data of the i st sample as $x(i,j)$, then there is a data set of all indicators as $\{x(i,j) \mid i = 1,2,...,n;\ j = l,2,...,m\}$, where n represents the number of samples to be evaluated and m represents the number of evaluation indicators, and the decision matrix A is obtained according to the results of the standardized processing of sample data.

For the standardization of positive indicators:

$$x_{ij} = \frac{x_{ij} - \min(x_j)}{\max(x_j) - \min(x_j)} \tag{4}$$

For normalization of negative indicators:

$$x_{ij} = \frac{max(x_j) - x_{ij}}{\max(x_j) - min(x_j)} \tag{5}$$

$$A = \begin{pmatrix} x_{11} & x_{12} & \cdots & x_{1m} \\ x_{21} & x_{22} & \cdots & x_{2m} \\ \vdots & \vdots & \ddots & \vdots \\ x_{n1} & x_{n2} & \cdots & x_{nm} \end{pmatrix}_{n*m} \tag{6}$$

2) Construct the projection indicator function. Construct the projection indicator function $Q(a)$, the projection tracing method is to synthesize the n -dimensional data $\{x_{ij} \mid j = I,...,m\}$ into a one-

dimensional projection value z_i with $a=\{a_1,a_2\ldots a_m\}$ as the projection direction, the formula is:

$$z_i=\sum_{j=1}^{m}a_j x_{ij}, i=1,2,...,n \tag{7}$$

Where a is the unit length vector, z_i is the projection value, the synthesis requires z_i to have the characteristics of local projection points as dense as possible, and the overall projection points are scattered as much as possible between them. Therefore, the available classification index is the objective function, and the formula is as follows:

$$Q_a = S_z \times D_z \tag{8}$$

where S_z is the standard deviation of z_i and D_z is the local density of z_i, which is given by:

$$S_z=\sqrt{\frac{\sum_{i=1}^{m}(z_i-\overline{z})^2}{n-1}} \tag{9}$$

$$D_z=\sum_{i}^{m}\sum_{j}^{n}(R-r_{ij})\times u(R-r_{ij}) \tag{10}$$

$$r_{ij}=\left|z_i-z_j\right|(i=1,\ldots,m;j=1,\ldots,n) \tag{11}$$

where $\overline{z}$ is the average value of z_i, R is the window radius of the local density, whose threshold can be taken as $0.1S_z, 0.01S_z$, etc., r_{ij} is the distance between the samples, and $u(p)$ is a one-unit step function with a value of 1 when $p=(R-r_{ij})\geq 0$ and 0 otherwise.

3) Determine the optimal projection indicator function. Because the sample data of each indicator is given, so the projection indicator function is only one variable of the projection direction vector, and the projection function is optimal when a is the maximum. Therefore, its maximization objective function and constraints expression is:

$$Max(Q_a) = S_z \times D_z \tag{12}$$

$$\sum_{j=1}^{m}a_j^2=1,\quad a_j\geq 0 \tag{13}$$

The above formula is more complicated to calculate the projection index function, and it is easier and more effective to solve the above problem by accelerated genetic algorithm (AGA).

4) Solving the optimization result. The optimal projection direction vector a obtained from step (2) can be used to calculate the objective weight value. In view of the complexity of the above objective function calculation process, this paper calculates the optimal projection direction with the help of programming software MATLAB to get the objective weights of the indexes W_2.

$$w_j=a_j^{\,2} \tag{14}$$

where w_j is the weight value of the jnd indicator and a_j is the value of the best projection direction of the jth indicator.

2.2.3. Combinatorial empowerment method. In this paper, game theory is applied to the calculation process of combinatorial assignment, considering the advantages and disadvantages of the main and objective assignment method, and its calculation process by constantly seeking the minimum deviation value between the two, to achieve the purpose of interactive decision-making between the two, and obtain the optimal integrated weight value. The calculation process is as follows:

Let W_1, W_2 improve the subjective weights determined by the G2 method and the objective weights determined by the RAGA-PP method, respectively, and α_1, α_2 be the combination coefficients of the

G2 and GA-PP methods, respectively, then the vector of their combined weights W is:

$$W = \alpha_1 W_1^T + \alpha_2 W_2^T \tag{15}$$

The optimization response model for the combination factor α_1, α_2 is:

$$\begin{cases} \min \alpha_1 W_1^T + \alpha_2 W_2^T - W_1^T{}_2 \\ \min \alpha_1 W_1^T + \alpha_2 W_2^T - W_1^T{}_2 \end{cases} \tag{16}$$

According to the matrix differentiation property, the first order derivative of Eq. (16) is obtained as:

$$\begin{cases} \alpha_1 W_1 W_1^T + \alpha_2 W_1 W_2^T = W_1 W_1^T \\ \alpha_1 W_2 W_1^T + \alpha_2 W_2 W_2^T = W_2 W_2^T \end{cases} \tag{17}$$

The corresponding system of linear equations with optimized first-order derivatives is:

$$\begin{pmatrix} W_1 W_1^T & W_1 W_2^T \\ W_2 W_1^T & W_2 W_1^T \end{pmatrix} \begin{pmatrix} \alpha_1 \\ \alpha_2 \end{pmatrix} = \begin{pmatrix} W_1 W_1^T \\ W_2 W_2^T \end{pmatrix} \tag{18}$$

After normalizing the combination coefficients α_1, α_2 obtained above, the final game theory based combination weights are obtained as:

$$W^* = \alpha_1^* W_1^T + \alpha_2^* W_2^T \tag{19}$$

Among them: $\alpha_1^* = \dfrac{\alpha_1}{\alpha_1 + \alpha_2}, \alpha_2^* = \dfrac{\alpha_2}{\alpha_1 + \alpha_2}$.

2.3. Modeling

The weighted score of the quality of cross-border composite music talent cultivation in higher vocational colleges and universities can be obtained through the previous section, and the multi-objective planning model of composite music talent cultivation mode is formed in this section through multi-objective planning, objective function and constraints construction.

2.3.1. Multi-objective planning. In order to enhance the fitness of higher vocational students with the quality improvement and cultivation environment, it is necessary to discern the fitness of students with the quality improvement and cultivation environment (i.e., the quality of composite music talent cultivation) in the process of talent cultivation, classify the grade, and then enhance the quality of talent cultivation according to the effective path, and truly achieve the evaluation of the teaching. Three optimization goals of the model:

1) To establish a model to classify the degree of fitness of higher vocational students and the environment of quality enhancement and cultivation, in order to achieve the purpose of discriminating the quality of higher vocational music talent cultivation results through the observation of weighted scores.

2) To minimize the difference between samples classified into the same grade and maximize the difference between samples of different grades.

3) The higher the grade, the lower the proportion of samples with low fitness to the quality improvement and excellence training environment contained in the grade.

2.3.2. Description of symbols. The construction of the rank discrimination model is based on the principle of maximizing the degree of difference in weighted scores between ranks and the principle of incremental rank assignment. The symbols involved and their descriptions are as follows:

U_i - The weighted score of the i nd sample, $i = 1, 2, \cdots, n$, n indicate the number of samples.

mh - $h = 1, 2, 3, 4, 5$, i.e., it indicates five ranks from highest to lowest, which are rank 1, rank 2, rank 3, rank 4, and rank 5.

U_{mh}^{h} - The mh th sample of the hth rank, i.e. the last sample of the hth rank.
U_{1}^{h+1} - The 1st sample of the h+1nd rank.
AVS_h - The mean of the hth rank assignment.
$n^{(h)}$ - The number of samples included in the hth rank.
bh - All samples in the hth rank.
G_{hi} - The i th sample of the hth rank assigned.

2.3.3. Objective function. The weighted score U_i from high to low in descending order, if it is divided into five levels 1-5, there will be four critical points. Make the four critical points before and after the sum of the difference between the weighted scores of the h samples is maximized, that is, to determine the second level of the last sample U_{mh}^{h} and the h+1th level of the first sample U_1^{h+1} weighted scores, and find the sum of the difference between the weighted scores of the four critical points, and maximize it. The objective function is shown below:

$$Obj1:\max O=\sum_{h=1}^{4}(U_{mh}^{h}-U_{1}^{h+1}),h=1,2,3,4 \tag{20}$$

Expanding equation (20) can be expressed as equation (21):

$$\max O=(U_{m1}^{1}-U_{1}^{2})+(U_{m2}^{2}-U_{1}^{3})+(U_{m3}^{3}-U_{1}^{4})+(U_{m4}^{4}-U_{1}^{5}) \tag{21}$$

$U_{m1}^{1}-U_{1}^{2}$ represents the difference between the 1st rank and the 2nd rank critical point, and similarly enumerates the difference between the remaining three critical points: the difference between the 2nd rank and the 3rd rank critical point is $U_{m2}^{2}-U_{1}^{3}$, the difference between the 3rd rank and the 4th rank critical point is $U_{m3}^{3}-U_{1}^{A}$, and the difference between the 4th rank and the 5th rank critical point is $U_{m4}^{A}-U_{1}^{S}$.

2.3.4. Constraints. The higher the rank, the more high grouping samples and the less low grouping samples are included, and the lower the rank, the less high grouping samples and the more low grouping samples are included, and this study assigns values to the high grouping and the low grouping respectively. This study assigns values to high and low subgroups separately. High subgroups are assigned a value of 1 and low subgroups are assigned a value of 2, so that the lower the rank, the higher the average value of the rank assignments, the above goal can be achieved, and the average value of the rank assignments is shown below:

$$AVS_h=\frac{\sum_{i\in bh}G_{hi}}{n^{(h)}} \tag{22}$$

In order for the grading to strictly adhere to the rating criterion that the lower the grade the higher the number of lower grouped samples included, the following constraints were established:

$$1\le AVS_1<AVS_2<AVS_3<AVS_4<AVS_5\le 2 \tag{23}$$

The reason for the constraint on the range of values in Eq. (23) is that rank 1 in the most extreme case is that it contains samples that are all highly grouped, i.e., the mean of the rank assignments is 1, and rank 5 in the most extreme case is that it contains samples that are all lowly grouped, i.e., the mean of the rank assignments is 2, and this constraint range is set accordingly.

2.4. Model solving

Regarding the solution of the model, it is necessary to determine the minimum value of the sample size for class 1, and then solve the model based on the traversal algorithm with the objective function and constraints with the help of Matlab software. The specific steps are as follows:
1) Import the raw data of weighted scores of all samples, calculate the difference of weighted scores

between each neighboring sample in the sample data, and sort the difference of all weighted scores in descending order. Read the distribution parameters and model parameters, store the sample data in the DATA variable, calculate the difference between the weighted scores of all the two neighboring samples in the sample data and sort them from the largest to the smallest, store them in the sort-gap variable, and record the numbered order of the sorted samples I.

2) Search to find the maximum interval using a traversal algorithm. Based on the principle of maximum difference in weighted scores between ranks, the first 20 values with the largest difference in weighted scores are selected to obtain the preorder sample numbers corresponding to each interval, and then the traversal search algorithm is used to find four preorder sample numbers from which the sample data are divided into five segments.

3) Based on the principle of increasing rank assignment, make the above five segments of data satisfy the following constraints: the sample size within each rank should not be too small, define the sample size of each segment as not less than the minimum value of x, and the mean of the assignment of the quality score of the sample results increases sequentially. Find the output with the largest sum of intervals from all combinations that satisfy the constraints.

3. Model solving and analysis of results

3.1. Indicator weights

Determine the weights of the evaluation indicators on the impact of evaluation variables. This study adopts the combination assignment method to assign the weights of the evaluation indicators. An indicator weighting evaluation group consisting of 15 people, including teachers, students and part-time teachers from enterprises, was formed to collect their scores on each indicator and calculate the weight coefficients of 6 first-level indicators and 24 second-level indicators. The results of the weights of the first-level and second-level indicators are shown in Figures 1 and 2, respectively. Among the first-level indicators, the weights of professional orientation A1, cultivation quality assurance and supervision A2, teacher competence A3, curriculum resources A4, teaching effect A5 and school-enterprise cooperation A6 are 0.097, 0.180, 0.154, 0.189, 0.156 and 0.224, respectively.The weights of the second-level indicators range from 0.014 to 0.066, with the weights of compound skills improvement B18, curriculum Practice Effect B16 and Student Enterprise Internship B20 have the largest weights, all above 0.06.

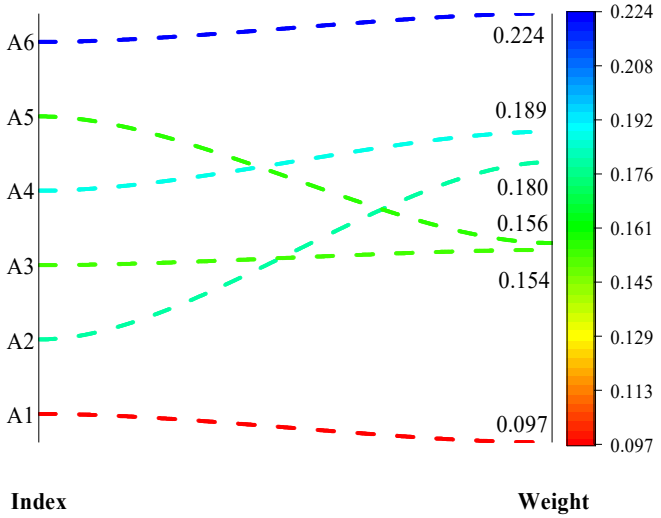

Fig. 1. The weight of the first level index

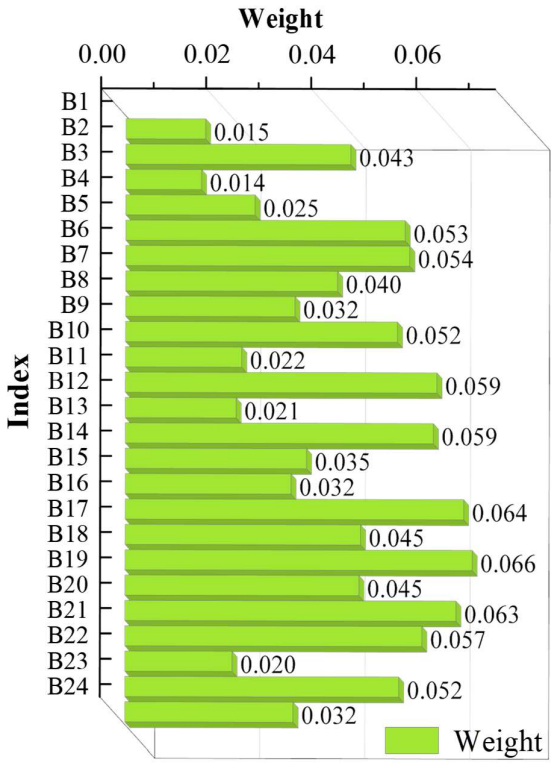

Fig. 2. The weight of the second level index

3.2. Sample Sources

Samples were collected by distributing questionnaires to faculty members and students of some colleges and universities in Q. The questionnaires were classified into six categories, namely, professional orientation, quality assurance and supervision of cultivation, teachers' competence, curriculum resources, teaching effectiveness and university-enterprise cooperation, and the topics corresponding to each level of indicators were the level two indicators. The scores of each respondent on the questions corresponding to the above six indicators were counted separately, and the data of 233 respondents were obtained. Figure 3 represents the number of respondents within each score band. In the survey scores of the six first-level indicators, most of the distribution of the number of people is concentrated in the three score bands of 41-50, 51-60 and 61-70, indicating that the six selected first-level indicators are all more important to the cross-border composite talent cultivation mode, and that the constructed indicator system has rationality.

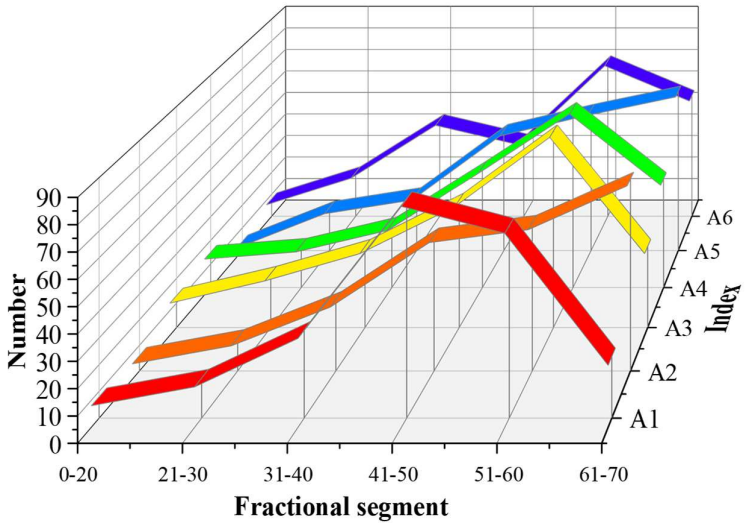

Fig. 3. The number of people polled in each section

3.3. Classification results

In order to verify the accuracy and practicability of the multi-objective planning model of compound music talent cultivation, the samples in the questionnaire are selected for simulation evaluation and hierarchical division. The results of the hierarchical division of the model are shown in Table 2. The five grades solved by the model correspond to the score intervals of [4.12, 5.00), [3.85, 4.12), [3.03, 3.85), [1.96, 3.03) and [1.96, 3.03), of which the sample of grade 3 accounts for the most 40.77%, followed by grade 4 and grade 2, and the quality of cross-border composite music talent cultivation of the sample colleges and universities is overall medium level.

Table 2. The solution of the model grade division

Scoring interval	Grade	Number	Proportion/%
[4.12, 5.00)	Grade 1	21	9.01%
[3.85, 4.12)	Grade 2	38	16.31%
[3.03, 3.85)	Grade 3	95	40.77%
[1.96, 3.03)	Grade 4	42	18.03%
[1.00, 1.96)	Grade 5	37	15.88%

The scoring results of each level 1 and level 2 indicators are shown in Figures 4 and 5. The scores of professional orientation A1, cultivation quality assurance and supervision A2, teachers' competence A3, curriculum resources A4, teaching effect A5 and school-enterprise cooperation A6 are 3.31, 2.64, 3.06, 2.91, 2.47, 3.06, and the evaluation levels belong to rank 3 and rank 4. Among the secondary indicators, only four indicators are classified as rank 1, which are students' cultivation standard B3, professional characteristics B4, teaching ability B9 and enterprise participation in music talent program design B21, with scores within the interval of [4.12, 5.00), and most of the indicators are located in rank 3 and rank 4.

Through the above multi-objective planning model, the quality of composite music talent training can be accurately evaluated, which effectively solves the problem of how to “teach according to the material” in the process of building cross-border composite music talent training model, and for the elements of different evaluation levels, teaching resources are purposefully tilted based on the construction of the overall quality and excellence environment. At the same time, for students of different evaluation levels, adopt targeted strategies to optimize music talent training, so that the construction of cross-border composite music talent training model is more efficient and scientific.

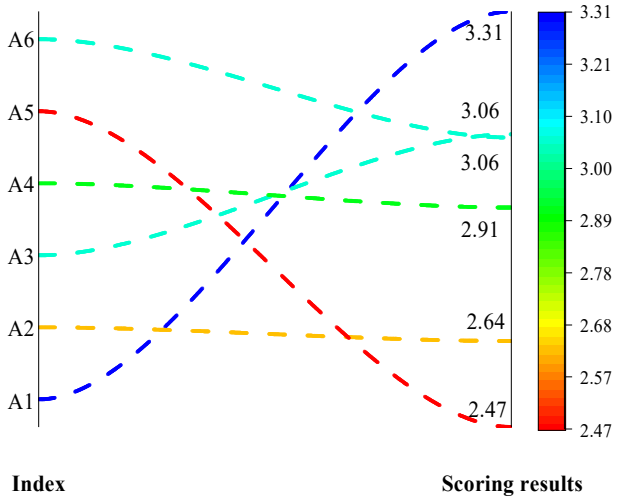

Fig. 4. The scoring results of the first level index

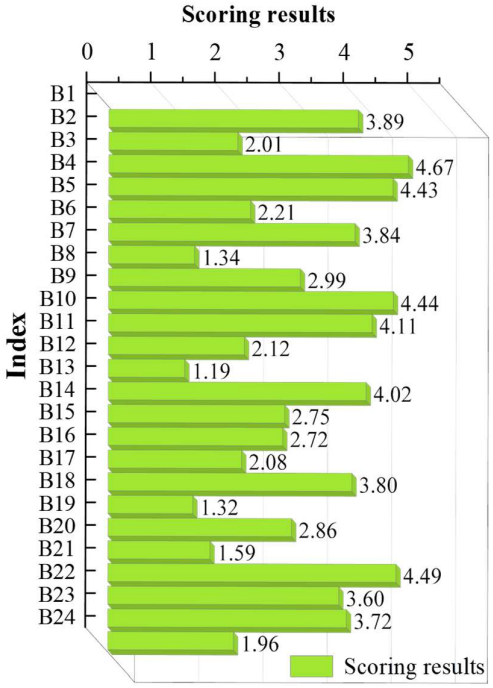

Fig. 5. The scoring results of the second level index

The construction of compound talent training system should fully consider the pluralism of the evaluation subject, the operability of the evaluation index and the comprehensiveness of the evaluation process. With the aim of cultivating students' comprehensive vocational ability, the college has conducted comprehensive evaluation, research and exploration on the training quality of compound talents from both internal and external aspects, from college teachers to enterprise experts, human resource management personnel and outstanding graduates. The quality evaluation system of compound talents is constructed, which is composed of course learning quality, enterprise internship identification, vocational skill level identification and graduate follow-up survey.

4. Countermeasures of cross-boundary compound music talent training mode

4.1. Current situation of music talent training in higher vocational colleges

1) Personnel training objectives and curriculum system can not be matched with post ability standards. First, the design of talent training objectives is single, not strong pertinence, lack of knowledge structure, ability structure, ability acquisition, professional quality and other aspects of the systematic setting, talent training lack of application, industry, local and practical characteristics, resulting in a large gap between the knowledge application ability of graduates and the actual local needs. The second is the lack of logic in course structure and course module construction, the lack of regional characteristics in course setting, the lack of flexibility in teaching content, the lack of comprehensive application of learning content, and the lack of professional skills to give full play to the platform, stage and other platforms, difficult to convert into work ability.
2) Outdated personnel training methods and old-fashioned teaching methods. On the one hand, the way of training music talents in higher vocational colleges is outdated, ignoring the complexity of teaching process, ignoring the dialectical relationship between teachers and students in teaching, and ignoring the impact of students' psychological and physiological factors on learning. On the other hand, the old-fashioned teaching methods, which emphasize teachers as the main body, ignore the teaching principle of "student-oriented, teacher-assisted", lead to students' thirst for knowledge, learning initiative, enthusiasm and creativity are restricted.
3) Lack of professional teaching resources. The lack of professional teaching resources for the training of music talents in higher vocational colleges, the shortage of high-quality education and teaching resources, the weakness of standardized and standardized teaching resources, the lack of music professional standards, curriculum standards, teaching activity design, teaching case material library and industry standard library construction, affect the promotion and implementation of information teaching in higher vocational colleges.

4.2. Training path for composite music talents

In the cultivation of composite music talents, "multi-skill" means that the cultivated music talents have the ability of teaching, counseling, activity organization, activity planning and performance. "A professional skill" means that the cultivated musical talent has a specialty in vocal singing skills, instrumental playing skills, dance performance skills, and chorus conducting skills. "Composite" refers to the cultivation of musical talents who can not only stand on the platform but also be active on the stage, and are versatile in adapting to the needs of professional positions. The training paths of composite music talents are as follows:
1) Build a curriculum system with job skills as the core. In view of the needs of music professional positions, the course structure of "professional quality + comprehensive skills + professional expertise" is constructed to form a module course integrating general education ability, professional basic ability, professional core ability and practical ability. Implement the teaching content of seamless connection between professional standards and professional standards, and build a composite music talent training curriculum system that conforms to the orientation of higher vocational music talent training and strengthens skill training.
2) Innovate ways and methods of personnel training aiming at vocational ability training. The way and method of training music talents in higher vocational colleges should be reformed and innovated according to the characteristics of music major. According to the combination of theory, practice and skills, direction, content and evaluation, professional, vocational and social combination of talent training. By innovating diversified training methods such as the combination of big and small classes and layered style, we can cultivate students with the composite characteristics of "multi-ability and one-specialty" with good comprehensive quality and strong professional and technical skills, and comprehensively improve the teaching quality.

3) Create a music talent training teaching resource bank. With the support of modern digital technology, we will build universal and personalized music teaching resources, including professional talent training programs, professional standards library, professional curriculum library, resource material library, independent learning library, and build a learning platform that can learn, teach and assist, systematic, personalized, independent and shared. It provides powerful help for teachers, students, post-service teachers and social music educators, and provides systematic overall curriculum teaching solutions and rich three-dimensional teaching resources for training composite music talents in higher vocational colleges.

5. Conclusion

In this paper, under the background of quality improvement and excellence training, the multi-objective planning model of composite talent cultivation mode is constructed through the selection of evaluation indexes, objective function and constraint function setting, etc., and the data are collected to solve and analyze the model. Finally, the construction countermeasures of compound talent cultivation mode in higher vocational colleges are proposed. The study completes the construction of the composite talent cultivation quality evaluation index system containing 24 indicators in 6 dimensions, and the composite skill improvement index and course practice effect index have the largest weights of 0.066 and 0.064. The interval length and student distribution of the five talent training quality levels are obtained, and it is found that the overall talent training quality of the sample universities is lower than the average level. Higher vocational colleges can adopt differentiated teaching strategies to improve students' comprehensive ability according to the results. The multi-objective planning model established in this paper obtains its composite talent cultivation effect through scientific and reasonable talent cultivation evaluation, which prompts vocational colleges and universities to reform the talent cultivation mode in time and improve the quality of talent cultivation. It can also enable students to correctly recognize their advantages and shortcomings in professional knowledge, skills and comprehensive quality, prompting them to actively seek personal development, timely knowledge updating and self-improvement.

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