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Research on the Adaptation Mechanism between English Majors in Higher Vocational Colleges and the Demands of Cultural Industries under the Orientation of International Communication Strategies

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SUMMARY: *The cultural industry of China has immense opportunities due to its abundant cultural heritage and the English language professionals can be considered an essential part of the implementation of international communication policies in the cultural industry. Building on existing literature, this paper presents a mechanism to match the cultural industry requirements of vocational college English programs in four different dimensions. In order to determine the actual effectiveness of this mechanism, three methods including Delphi method, online hierarchical analysis, and optimal solution distance analysis have been used to measure the alignment mechanism between English programs and cultural industry requirements. The analysis shows that the index of relative alignment increased between 2014-2023 by 0.4433 to 0.5979. It means that as time passes, the real worth of this alignment mechanism between vocational colleges' English programs and cultural industry demands grows more and more important. Vocational colleges are solving the problem of industry needs by providing English professionals to cultural sector, which also improves the compatibility of this sector with international communication measures.*

KEYWORDS: *Delphi method; Network Analytic Hierarchy Process; Advantage Solution Distance Method; Alignment Mechanism; Cultural Industry; Higher Vocational Colleges*

1 Introduction

Communication and exchange between nations have become more convenient in a world in which the economic and cultural globalization keeps on growing stronger. Being the most spoken language in the world, English has played an important role in enabling communication and interaction among various countries [1, 2]. The cultural industry is a creative industry that consists of culture, technology, innovation, and distribution [3]. Talent has performed a proactive role in the emergence of contemporary cultural industries which are used as the basis and the driving force [4]. Language and cultural barriers make the process of globalization communication challenging but English being extensively used has become a useful device with regard to the spread of cultural industries through the internationalization of this sphere [5].

In order to further the international cultural industry, creation and perfection of the talent development, hiring and recruitment systems that will be in tandem with the requirements of

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the industry on creative professionals are necessary to protect the talent as the key internal driving force in the development of the cultural and creative industries[6]. The alignment mechanism of the vocational college English programs and the cultural industry demands should be especially studied and researched within the framework of the strategic orientation of international communication.

The cultural industry is a systemic process and its growth cannot be achieved without a well-developed talent cultivation system[7]. To further the development of the cultural industry, Ji et al.[8] came up with recommendations concerning the education of professional theory and practice. They pointed out that the development of innovative design talents that can go hand in hand with societal needs leads to sustainable development within the design disciplines and also meets the demands of the cultural and creative industries. Qunzhen et al. [9] performed a detailed analysis of problems in talent cultivation in the Chinese marine cultural industry, specifically the lack of specialized professionals. According to this analysis, they developed special talent development strategies to ensure that the match between specialized talents and the marine cultural industry could be increased. Xia [10] examined the development of the major cultural industries of Tianjin and the supply and demand dynamics of the talents in those industries using questionnaires and interviews. The research offered viable measures on how Tianjin universities would nurture specialized cultural industry experts, who should help develop the cultural industry in Tianjin. Tong et al. [11] took apart the historical context of the talent demand in the cultural industry and the drivers behind the talent cultivation. Identifying the necessity to develop talent in the IP cultural industry, they suggested such strategies as the creation of cooperative education systems, the specification of the educational material, and the enhancement of the platform development to use the so-called IP boom to propel cultural industry development.

To sum up, the new era of cultural industry development cannot be achieved without positioning talent as the center. It involves the deliberate creation of scientific and institutionalized systems of talent management and incentives that would help align talent with the requirements of the cultural industries [12, 13]. The effective use of talent on all fronts will render them an infinite source of inspiration to the development of the cultural industry and thus aid in the accelerated development of various other industries that are related to it, among them the cultural sector.

The current paper focuses on pertinent research literature in order to come up with a mechanism that can be used to align vocational college English programs along with the demands of the cultural industry in four areas, namely, English talent development, overall qualities and competencies, collaboration between the industry, academia and research, and the actions of the government. In terms of assessing the applicability and correspondence of the mechanism, an assessment model based on the Delphi approach, online hierarchy analysis, and optimal solution distance analysis was used to perform empirical studies of the correlation mechanism between the vocational college English program and the requirements of the cultural industry.

2 Exploring the Alignment Between English Majors and Cultural Industry Needs

2.1 Adaptation Mechanism

2.1.1 Establish a Mechanism for Cultivating English Talent

In order to improve the correspondence between the English major students and the demands of the cultural industry, there is a need to create a multifaceted talent development system. The mechanism must include such aspects as: Firstly, come up with specialized training programs that consist of educational goals, curriculum, and methods of teaching so as to create an environment where the English professionals are developed to match the requirements of the cultural industry. Secondly, specialist training centers should be set up by higher vocational schools to offer professional guidance in language proficiency, cultural literacy, and knowledge of the cultural industry. Thirdly, institutions can motivate more talent to join the program by offering scholarships to encourage learning and research. Fourthly, a strong evaluation system should be put in place to evaluate the competence of graduates and ascertain that they conform to the industry standards hence promoting the stability of cultural industries international communication strategies.

2.1.2 Enhancing Comprehensive Quality and Capabilities

To align English majors with cultural industry needs, it is necessary to balance cultural heritage preservation and language proficiency. In terms of traditional culture, training courses are required to include folklore, folk art, and traditions to improve the level of professional competence of vocational college English majors. Meanwhile, they need to acquire fluency in both national common language and ethnic language and be aware of cultural differences within regions. It can be done by intensifying language acquisition, increasing cultural awareness, enhancing professional skills, raising awareness of services, and boosting team work abilities. Such a step will make cultural industries grow internationally, which will add value to the quality development and the emergence of international influence in the new era.

2.1.3 Strengthen Industry-Academia-Research Collaboration

In order to further enhance the interaction between the vocational college English courses and the requirements of the cultural industry, it is necessary to adopt an industry-academia-research collaboration model. The collaboration must include the following points: Firstly, create industry-academia-research centres where vocational college English students and the cultural industry can participate in exchange and cooperation. Secondly, increase information sharing. Information-sharing platforms can be created by governments allowing stakeholders of cultural industries, universities and research institutions to keep up with international communication strategy trends and industry requirements and thus build a more solid base of collaboration. Thirdly, start project-based research. Such projects would have to be implemented by the vocational college English majors and cultural industries together exploring the international communication strategies and issues of high quality development, their ability to conduct research and proficiency. Fourthly, establish exchange platforms. English majors in vocational colleges and cultural industries may collaborate and exchange on these platforms to share experiences and resources and align vocational English programs with the requirements of the cultural industry.

2.1.4 Government Actions

The government may adopt efficient solutions in these areas to improve the compatibility between vocational college English programs and the requirements of the cultural industry.

The first step is to raise educational spending. The government could increase the level of funding on vocational college education, create interdisciplinary courses that are related to local culture, language, and cultural industries, as well as offer students internship and job opportunities to enhance the practical application skills.

Thirdly, develop supporting policies. The government may also create policies that would motivate cultural industries to hire, train and employ English majors; motivate the growth of English talent; and support the growth of regional cultural industries by offering such incentives as tax breaks or hiring subsidies. These policies must encourage companies to engage in proactive training and employment of English professionals.

2.2 Adaptation Mechanism Evaluation Plan

The current section is aimed at evaluating the alignment mechanism of English programs offered by vocational colleges with the needs of the cultural industry in order to determine the general level and extent of this alignment. It has great value in the context of cultural industry development in terms of international communication strategy, since the results of the evaluation show whether the alignment mechanism complies with the requirements of international communication strategies.

2.2.1 Preliminary Construction of the Indicator System

(1) Principles of Construction

(a) Principle of Applicability

The applicability principle was introduced to be more effective in reconciling the concept of design of the evaluation indicator system and the actual operating environment of its adaptation mechanism. It guarantees both the theoretical completeness and correctness of the assessment, as well as the practical applicability of the indicators in practice. The application of this principle can be justified theoretically as well as practically. In building the indicator system, the direction of cultural industry development, economic conditions, international communication strategies, and English majors at higher vocational colleges are all taken into consideration, which is indicative of the importance of the applicability principle.

(b) Scientificity Principle

Principle of scientificity is introduced to make sure that the system of evaluation indicators has a proper research basis, which increases accuracy and reliability during practical implementation. Introduction of this principle not only assures the scientific rigour of evaluation at the theoretical level, but also ensures scientific dependability of indicator choice, data gathering and analysis in practice. Scientific principle is evident in considering all aspects of various fields, which helps to create interdependence between indicators. Such interconnectedness enables building a holistic and organized evaluation system to avoid having a narrow approach to any element and more effectively address the problem of the alignment between vocational college English programs and cultural industry requirements.

(2) Development Process

This study has preliminarily formulated an assessment index of the alignment process between the English programs in the vocational colleges and the needs of the cultural industry based on relevant references that are presented in Table 1. As it can be seen in the table, this evaluation model has 6 main indicators and 24 sub-indicators.

Table 1: Evaluation index system

First-level indicator	Symbol	Secondary indicators	Symbol
Professional positioning adaptation	Q1	The alignment of professional training objectives with the demand for international cultural communication talents	Q11
		Professional direction setting	Q12
		The talent specification positioning meets the compound requirements of "English + culture + skills" for international communication	Q13
		The alignment of professional development planning with the international communication strategy of regional cultural industries	Q14
Curriculum system adaptation	Q2	International communication courses	Q21
		Cultural industry courses	Q22
		English skills courses	Q23
		The update of course content is in step with the latest trends in the international communication of the cultural industry	Q24
Adaptation of the teaching staff	Q3	Teachers with relevant working experience in international communication or the cultural industry	Q31
		Teachers with cross-cultural communication skills	Q32
		Teachers participating in international cultural industry communication projects	Q33
		Dual-qualified teacher	Q34
The adaptability of practical teaching	Q4	Cooperate with cultural enterprises to establish practice bases	Q41
		Students participate in international cultural communication practice projects	Q42
		The matching of practical education content with the actual job requirements for international communication of the cultural industry	Q43
		Students complete relevant achievements in international communication through practice	Q44
		Practical teaching assessment standards and cultural position competency requirements	Q45
The compatibility of industry-education integration	Q5	The depth of cultural enterprises and the formulation of professional talent cultivation plans	Q51
		Jointly develop international communication textbooks or teaching resources by schools and enterprises.	Q52
		Enterprise experts participate in classroom teaching	Q53
		Carry out research on international cultural communication through school-enterprise cooperation	Q54
Quality feedback adaptability	Q6	The employment situation of graduates in international communication positions in the cultural industry	Q61
		Employers' views on graduates' international communication capabilities	Q62
		Graduates' views on the compatibility of professional teaching with the demands of the cultural industry	Q63

2.2.2 Revision of the Indicator System Based on the Delphi Method

This paper will use literature analysis to build preliminary evaluation models based on 24 secondary indicators. This model is based on six major dimensions namely; professional positioning alignment, curriculum system alignment, faculty alignment, practical teaching alignment, industry education integration alignment, and quality feedback alignment. It is now being used with the Delphi method to scientifically maximize and perfect this indicator system. In this step, the arithmetic mean, standard deviation, and coefficient of variation of all the evaluation indicators were calculated using Excel and SPSS 26.0. Arithmetic mean (M) is the most popular measure of central tendency that explains the overall level of a data set. Larger arithmetic mean implies higher expert agreement on the value of the evaluation indicator, which is more significant. Standard deviation (S) is a statistical measure of the spread of data in a dataset, which means the extent to which the data values deviate from the arithmetic mean. Lower standard deviation means lesser variation in the opinions of experts on the evaluation indicator and hence more agreement among the experts and increased level of recognition of the indicator. Relative dispersion is indicated by Coefficient of Variation (CV), which is the ratio of the standard deviation to the mean. A low CV means less variability between experts ratings and high CV means more variability. The formula of CV is:

$$CV = \frac{S}{M} \tag{1}$$

One common belief is that the arithmetic average of an assessment measure is $M \leq 4$ or its coefficient of variation is $CV \geq 0.1$, then the measure is considered as not having enough expert agreement and it should be discarded with $M > 4$. Conclusively, this paper has come up with the following retention requirements of the metrics: the arithmetic mean should be $CV < 0.1$ and the coefficient of variation must be .

(1) Expert Selection for Consultation

When building an evaluation indicator system with the application of the Delphi method, the choice of an expert team will influence the scientific rigour and authority of the ultimate indicator system. The expert panel must be moderate. Too many experts add to the complexity and work load of forecasting, make it less practical, and can result in resource waste or inability to come to a consensus. On the other hand, with too few experts, the indicator system might not be comprehensive, representative, and authoritative, so the views of the minority could prevail. Typically, the number of experts on the panel must be limited to no more than 15 people depending on the size of the project and the level of research required. The details on the consulted experts are presented in Table 2. The composition of the experts involved in the present research consisted of authoritative scholars who have vast experience in conducting research in the fields of international communication, cultural industries, and English studies, which made the indicator system scientifically rigorous.

Table 2: Consult the basic information of the expert

No.	Name	Professional title	Work experience	Gender
1	Expert A	Professor	More than 30 years	Female
2	Expert B	Professor	More than 30 years	Male
3	Expert C	Professor	15 to 30 years	Male
4	Expert D	Professor	15 to 30 years	Male
5	Expert E	Associate Professor	Less than 15 years	Female
6	Expert F	Professor	More than 30 years	Male
7	Expert G	Professor	More than 30 years	Male
8	Expert H	Professor	More than 30 years	Male
9	Expert I	Deputy Section	Less than 15 years	Female
10	Expert J	Section Chief	More than 30 years	Male

(2) Expert Engagement Coefficient and Authority Coefficient

(a) Expert Engagement Coefficient

The coefficient of expert involvement is a metric that is applied to assess the degree of enthusiasm and involvement of experts participating in the Delphi process or other methods of expert consultation. It is usually determined and evaluated depending on such indicators as the response rate of the expert per round of the questionnaire, the amount of detail in the answer, the consistency of opinions between different rounds and the constructiveness of feedback given. Expert engagement coefficient is indicated in Table 3. As can be seen in the table, the two rounds of questionnaire consultation gave out 10 copies each and all were returned. Expert engagement coefficient was 100% which indicates high level of enthusiasm among the panelists. Experts with high engagement coefficients participate to guarantee the quality and reliability of data.

Table 3: Expert positivity coefficient

Distribution rounds	Distribute questionnaires	Return questionnaire	Valid questionnaire	Recovery rate	Effective recovery rate
The first round	10	10	10	100.00%	100.00%
The second round	10	10	10	100.00%	100.00%

(b) Expert Authority Coefficient

The Expert Authority Coefficient (CR) has a significant effect on the reliability of the predicted results of the questionnaire consultation. It is usually made up of two sub-factors: Basis of Judgment (Ca) and Familiarity (Cb). The main categories of Basis of Judgment include four sub-categories: Theoretical Analysis (N1), Practical Experience (N2), literature references (N3), and subjective judgment (N4). The experts evaluate on their own the impact of these four sources of judgment on their answers, which are measured in Table 4. Level of familiarity is the extent of competence of the panelists in the field of the questionnaire content, which is reflected in Table 5. Expert Authority Coefficient is given in Table 6. The basis of the judgment is the total quantified score in relation to these four bases, as computed in the following formula:

$$Ca = N_1 + N_2 + N_3 + N_4 \quad (2)$$

The expertise authority coefficient is a mathematical average between the judgment basis and the level of familiarity, which is determined by the following formula:

$$C_R = \frac{C_a + C_b}{2} \quad (3)$$

It is commonly agreed that an expert authority coefficient of more than 0.7 is acceptable. According to Table 6, all the experts on the expert panel in the present study had the authority coefficients of more than 0.7 and all of them attained values of 0.7 or above (100%). This means that the results of the expert survey are highly reliable and thus the scores obtained at the levels of the objectives, criteria and indicators have considerable weight.

Table 4: The basis for expert indicator judgment is quantified

Basis for judgment	The degree of influence of the basis for judgment		
	Big	Medium	Small
Theoretical analysis	0.6	0.3	0.2
Work experience	0.1	0.2	0.1
Literature analysis	0.1	0.2	0.2
Subjective judgment	0.2	0.1	0.1

Table 5: Quantification of expert indicator familiarity

Degree of familiarity	Very familiar with	Relatively familiar	Generally familiar	Not very familiar with	Very unfamiliar
Self-assessment and assignment by experts	1.0	0.8	0.6	0.4	0.2

Table 6: Expert authority coefficient

Name	Basis for judgment	Degree of familiarity	Expert authority coefficient
Expert A	0.9	1	0.95
Expert B	0.7	0.8	0.75
Expert C	0.8	0.7	0.75
Expert D	0.8	1	0.9
Expert E	0.8	0.9	0.85
Expert F	0.8	1	0.9
Expert G	0.7	0.8	0.75
Expert H	0.9	0.7	0.8
Expert I	0.9	0.9	0.9
Expert J	0.9	0.9	0.9

2.2.3 Calculation of Indicator Weights Based on ANP

(1) Analytic Network Process (ANP)

The Analytic Hierarchy Process (AHP) incorporates both subjective judgement and objective analysis and is very appropriate in multi-objective evaluation issues when weight determination is involved [14]. Nevertheless, the weaknesses of AHP are also obvious: the indicators in each layer are regarded as independent and non-interactive. In the real world, the factors of indicators usually have interdependence and equilibrium, so it is unlikely that indicators in the same layer do not affect one another. In order to solve this problem, the Network Analysis Method (ANP) was developed to compute indicator weights. ANP has the advantage over AHP in that it represents the complex relationships between factors instead of hierarchical structure, strictly top-down as in AHP, which eliminates the drawback of the hierarchical system of AHP. ANP consists of a control layer and a network layer. Control layer is similar to the objective layer in AHP where the decisions objectives are first defined and then the decision criteria based on these objectives are established. All the criterion layers could be represented as individual network structures, forming a complex network architecture. ANP is based on the assumption that there are no detailed interdependencies among the criteria in the target decision, and therefore, the same weight calculation approach is applied to criteria against the objective. The network layer is a network structure created by the interrelations of the elements. As opposed to the rigid linear hierarchical relationships in AHP, the network layer permits mutual interaction not just between the indicators of each criterion but between various criteria. It may be understood that influence relationships are present across the entire network structure. To determine the weights of every indicator, ANP makes use of a supermatrix. This model is significantly consistent with actual problems. By substituting the top-down membership hierarchies with the complex network structures, the computed weights of the decision-making objectives become much more compelling. Therefore, ANP is more scientifically rigorous and practically applicable.

(1) Constructing the Indicator Network Structure Model

In accordance with the three-tier gradient indicator hierarchy, develop a network hierarchical structure model consisting of two elements, namely, the control layer and the network layer. The control layer includes decision objectives and control criteria, while the network layer consists of elements governed by the control layer indicators. For instance, if the evaluation of the alignment mechanism between vocational college English programs and cultural industry demands under international communication strategy orientation serves as the decision objective at the control layer, then first-level indicators are selected as the control criteria for this layer. Next, network-layer elements for each first-level indicator are constructed. Taking first-level indicator Q1 as an example, it comprises four second-level indicators: Q11, Q12, Q13, and Q14. Similarly, network-layer elements for Q2, Q3, Q4, Q5, and Q6 are established. Subsequently, the interrelationships among Q1 indicators are defined. By reviewing relevant literature and integrating findings from industry expert interviews, an influence relationship matrix among indicators is constructed.

(2) Calculation Process

Based on the influence matrix, it is evident that the indicators are independent and do not influence each other. Industry experts, practitioners, and researchers were invited to independently score the indicators using a 1-9 scale, comparing the importance levels of indicators within the same tier. The comparative importance levels and scoring methods for each indicator are shown in Table 7.

Table 7: Comparison of the importance of each indicator and their values

<table>
<tr><td>Scale value</td><td colspan="2">Meaning</td></tr>
<tr><td>1</td><td>Both are equally important</td><td rowspan="6">The former compared with the latter</td></tr>
<tr><td>3</td><td>The former is slightly more important than the latter</td></tr>
<tr><td>5</td><td>The former is obviously more important than the latter</td></tr>
<tr><td>7</td><td>The former is much more important than the latter</td></tr>
<tr><td>9</td><td>The former is extremely important than the latter</td></tr>
<tr><td>2, 4, 6, 8</td><td>The degree of importance lies between the above</td></tr>
<tr><td>1/Importance degree value</td><td>The degree of importance is the above value</td><td>The latter is compared with the former</td></tr>
</table>

After compiling the scoring results and inviting experts for discussion and analysis, a comparative judgment matrix was obtained. The 1-9 scale method enables explicit assessment and evaluation of the relative importance among indicators while simultaneously performing consistency checks. Using the scores from the 1-9 scale method, construct the comparative judgment matrix X. X satisfies three conditions: ① $x_{ij} > 0$, ② $x_{ii} = 0$, ③ $x_{ij} = \frac{1}{x_{ji}}$.

The resulting judgment matrix cannot directly serve as a basis for quantifying indicator importance and requires consistency testing. The ratio of the difference between the largest eigenvalues $\lambda_{\max}$ and n (where n is the order of the judgment matrix) to $n-1$ is introduced as an indicator CI measuring the deviation of the judgment matrix from consistency, namely:

$$CI = \frac{\lambda_{\max} - n}{n-1} \tag{4}$$

The ratio of the consistency index CI to the average random consistency index RI (average random consistency index) for the order n is denoted as CR, that is:

$$CR = \frac{CI}{RI} < 0.1 \tag{5}$$

Passed consistency testing. The normalized eigenvectors serve as the indicator weights.

Second-level indicators reside at the network layer, where ANP is employed to compute indicator weights through the following steps: Step 1: Conduct pairwise comparisons among network elements to generate a judgment matrix. Step 2: Construct an unweighted initial hypermatrix using the eigenvector method based on the judgment matrix. Step 3: Calculate the weighted hypermatrix. Step 4: Determine indicator weights by computing the limit hypermatrix.

2.2.4 TOPSIS-Based Comprehensive Evaluation

The fundamental principle of the Two-Operator Partial Index System (TOPSIS) is to select, from the numerical values of each indicator in the evaluation scheme, the value that best represents the optimal performance of that indicator to form the ideal optimal solution, and the value that represents the worst performance to form the worst solution [15]. By calculating the Euclidean distances between each indicator of the research proposal or object and both the optimal and worst solutions, the relative proximity of the proposal or object is determined. A higher proximity value to the positive ideal solution indicates a better proposal, while a lower value suggests a poorer proposal. The fundamental steps for solving the TOPSIS method are as follows:

(1) Establish the initial matrix R. According to the acquired evaluation object indicator data information, assign each indicator specific indicator values to form the initial matrix, assuming the existence of m evaluation objects $Q_1, Q_2 \cdots, Q_m$, n evaluation indicators $I_1, I_2, \cdots, I_n$ when r_i, is the indicator value $(i = 1,2,3,\cdots,m; j = 1,2,3,\cdots,n)$ of the evaluation object P_i corresponding to the evaluation indicator I_j, and the initial matrix obtained is $R(r_{ij})_{m\times n}$:

$$R(r_{ij})_{m\times n}=\begin{bmatrix} r_{11} & r_{12} & \cdots & r_{1n} \\ r_{21} & r_{22} & \cdots & r_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ r_{m1} & r_{m2} & \cdots & r_{mn} \end{bmatrix} \tag{6}$$

(2) Indicator data processing. Indicator data are processed in a dimensionless manner, and the processed indicator is $r_{ij}^{'}$, where the benefit-type indicator (the larger the value, the better the type of indicator):

$$r_{ij}^{'}=\frac{r_{ij}-\min\limits_{1\le i\le m}(r_{ij})}{\max\limits_{1\le i\le m}(r_{ij})-\min\limits_{1\le i\le m}(r_{ij})} \tag{7}$$

Cost-based indicators (the smaller the value, the better the indicator):

$$r_{ij}^{'}=\frac{\max\limits_{1\le i\le m}(r_{ij})-r_{ij}}{\max\limits_{1\le i\le m}(r_{ij})-\min\limits_{1\le i\le m}(r_{ij})} \tag{8}$$

The dimensionless processed matrix is $R^{'}(r_{ij}^{'})_{m\times n}$, then:

$$R^{'}(r_{ij}^{'})_{m\times n}=\begin{bmatrix} r_{11}^{'} & r_{12}^{'} & \cdots & r_{1n}^{'} \\ r_{21}^{'} & r_{22}^{'} & \cdots & r_{2n}^{'} \\ \vdots & \vdots & \ddots & \vdots \\ r_{m1}^{'} & r_{m2}^{'} & \cdots & r_{mn}^{'} \end{bmatrix} \tag{9}$$

(3) Construct the weighting matrix Q. The weight of each indicator is set as $\omega=(\omega_1,\omega_2,\cdots,\omega_n)$, and the weights of each indicator satisfy $\sum_{j=1}^{n}\omega_j=1$, which constitutes the weighting matrix as $Q(q_i)_{m\times n}$:

$$Q(q_{ij})_{men}=\begin{bmatrix} r_{11}^{'} & r_{12}^{'} & \cdots & r_{1n}^{'} \\ r_{21}^{'} & r_{22}^{'} & \cdots & r_{2n}^{'} \\ \vdots & \vdots & \ddots & \vdots \\ r_{m1}^{'} & r_{m2}^{'} & \cdots & r_{mn}^{'} \end{bmatrix}\begin{bmatrix} \omega_1 & 0 & \cdots & 0 \\ 0 & \omega_2 & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & \cdots & \omega_n^{'} \end{bmatrix}=\begin{bmatrix} q_{11} & q_{12} & \cdots & q_{1n} \\ q_{21} & q_{22} & \cdots & q_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ q_{m1} & q_{m2} & \cdots & q_{mn} \end{bmatrix} \tag{10}$$

(4) and the optimal and worst solutions are determined. After the indicator data are processed without dimension, the optimal solution is expressed as:

$$S^{+}=\{s_j^{+}\mid j=1,2,...,n\}\} \tag{11}$$

$$s_j^{+}=\max\limits_{1\le i\le m}\{q_j\},(j=1,2,...,n) \tag{12}$$

The worst solution is expressed as:

$$S^- = \{s_j^- \mid j = 1, 2, ..., n\}\} \quad (13)$$

$$s_j^- = \min_{1 \le i \le m}\{q_{ij}\}, (j = 1, 2, ..., n) \quad (14)$$

(5) Calculate the Euclidean spatial distance between each evaluation object and the optimal solution and the worst solution. The Euclidean space distance from the optimal solution is Sd_i^+, and the Euclidean space distance from the worst solution is Sd_i^-:

$$Sd_i^+ = \sqrt{\sum_{j=1}^{n}(s_j^+ - q_{ij})^2}, (i = 1, 2, ..., m) \quad (15)$$

$$Sd_i^- = \sqrt{\sum_{j=1}^{n}(s_j^- - q_{ij})^2}, (i = 1, 2, ..., m) \quad (16)$$

(6) Calculate the relative closeness of each evaluation object. For the

$$C_i = \frac{Sd_i^-}{Sd_i^+ + Sd_i^-}, (i = 1, 2, ..., m) \quad (17)$$

The evaluation objects are ranked according to their relative closeness. A larger value of C_i indicates a more desirable level of indicators for the evaluation object, and a smaller value of C_i represents a worse level of indicators for the evaluation object.

3 Analysis of empirical studies

3.1 Analysis of the process of revising the indicator system

3.1.1 First round of revision of the indicator system

(1) Level 1 Indicators

After collecting, organizing and integrating the first round of feedback, the revised indicators include 6 first-level indicators, 25 In order to further test and adjust these indicators, the form of Likert (Likert) 5-point scale is used to score and evaluate the indicators at all levels. According to the data processing instructions in Chapter 2, it is necessary to unfold the processing of the mean, median, standard deviation, coefficient of variation, using SPSS software after the statistical analysis of descriptive statistics and non-parametric tests, the parameters of the first round of statistical analysis of the first level of indicators are shown in Table 8. The mean, standard deviation and coefficient of variation of the first-level indicators all meet the requirements for the selection of indicators, so there is no need to make adjustments to the first-level indicators in the first round of the revision of the indicator system.

Table 8: Statistical analysis parameters of the first-round first-level indicators

First-level indicator	Average	Standard deviation	Coefficient of variation	Result
Q1	4.494	0.34	0.076	Reserve
Q2	4.915	0.209	0.043	Reserve
Q3	4.961	0.363	0.073	Reserve
Q4	4.284	0.217	0.051	Reserve
Q5	4.787	0.351	0.073	Reserve
Q6	4.361	0.331	0.076	Reserve

(2) Secondary indicators

The statistical analysis parameters of the second-level indicators in the first round are shown in Table 9, and the bolded words in the table are the values that do not meet the requirements. As can be seen from the table, the average value of Q14 and Q45 is lower than 4 and the coefficient of variation is greater than 0.1, so it is necessary to delete these two secondary indicators. For the other secondary indicators, the data are within the range of standardized values and have a high degree of recognition by experts, so they do not need to be revised.

Table 9: Statistical analysis parameters of the first-round secondary indicators

Secondary indicators	Average value	Standard deviation	Coefficient of variation	Result
Q11	4.535	0.282	0.062	Reserve
Q12	4.212	0.381	0.09	Reserve
Q13	4.082	0.219	0.054	Reserve
Q14	**1.884**	0.372	**0.197**	Delete
Q21	4.266	0.382	0.09	Reserve
Q22	4.885	0.246	0.05	Reserve
Q23	4.158	0.311	0.075	Reserve
Q24	4.067	0.389	0.096	Reserve
Q31	4.534	0.346	0.076	Reserve
Q32	4.065	0.358	0.088	Reserve
Q33	4.885	0.384	0.079	Reserve
Q34	4.692	0.273	0.058	Reserve
Q41	4.728	0.25	0.053	Reserve
Q42	4.78	0.264	0.055	Reserve
Q43	4.507	0.26	0.058	Reserve
Q44	4.216	0.399	0.095	Reserve
Q45	**1.701**	0.386	**0.227**	Delete
Q51	4.795	0.294	0.061	Reserve
Q52	4.606	0.308	0.067	Reserve
Q53	4.614	0.376	0.081	Reserve
Q54	4.608	0.395	0.086	Reserve
Q61	4	0.392	0.098	Reserve
Q62	4.749	0.324	0.068	Reserve
Q63	4.655	0.282	0.061	Reserve

3.1.2 Second round of revision of the indicator system

(1) First-level indicators

After the first round of expert opinion survey on the indicators adjusted to include 6 first-level indicators and 22 second-level indicators, and take the same method mentioned above to carry out the second round of the first-level indicator system revision analysis, the second round of the first-level indicator statistical analysis parameters as shown in Table 10. The results show that the average of the six first-level indicators in this round is greater than the standard value of 4, which indicates that experts have a high degree of recognition of these indicators. At the same time, the coefficients of variation are all less than 0.1, which indicates that the experts' evaluation of these indicators is relatively consistent and not overly dispersed, further confirming the high feasibility of the current round of level 1 indicators.

Table 10: Statistical analysis parameters of the second-round first-level indicators

First-level indicator	Average	Standard deviation	Coefficient of variation	Result
Q1	4.068	0.329	0.081	Reserve
Q2	4.405	0.201	0.046	Reserve
Q3	4.645	0.213	0.046	Reserve
Q4	4.347	0.34	0.078	Reserve
Q5	4.33	0.286	0.066	Reserve
Q6	4.061	0.26	0.064	Reserve

(2) Secondary indicators

The statistical analysis parameters of the second round of secondary indicators are shown in Table 11. It can be seen that the average of the secondary indicators Q24, Q34, Q44 and Q54 are less than the standard value of 4, and the coefficient of variation is greater than the standard value of 0.1, for this reason to be excluded from the treatment, while the remaining 18 secondary indicators values are within the range of the standard value, they are all retained in the treatment.

Table 11: Statistical analysis parameters of the second round of secondary indicators

Secondary indicators	Average value	Standard deviation	Coefficient of variation	Result
Q11	4.515	0.335	0.074	Reserve
Q12	4.521	0.343	0.076	Reserve
Q13	4.689	0.257	0.055	Reserve
Q21	4.713	0.38	0.081	Reserve
Q22	4.675	0.368	0.079	Reserve
Q23	4.777	0.253	0.053	Reserve
Q24	**2.325**	0.338	**0.145**	Delete
Q31	4.893	0.295	0.06	Reserve
Q32	4.849	0.317	0.065	Reserve
Q33	4.92	0.318	0.065	Reserve
Q34	**2.775**	0.308	**0.111**	Delete
Q41	4.779	0.371	0.078	Reserve
Q42	4.74	0.264	0.056	Reserve
Q43	4.356	0.364	0.084	Reserve
Q44	**2.257**	0.256	**0.113**	Delete
Q51	4.536	0.222	0.049	Reserve
Q52	4.988	0.318	0.064	Reserve
Q53	4.217	0.286	0.068	Reserve
Q54	**2.13**	0.355	**0.167**	Delete
Q61	4.564	0.296	0.065	Reserve
Q62	4.926	0.333	0.068	Reserve
Q63	4.017	0.321	0.08	Reserve

3.1.3 Determination of the system of evaluation indicators

After two rounds of revision and processing of the evaluation index system, the index system for assessing the mechanism of adapting the English majors of higher vocational colleges to the needs of the cultural industry was finalized, and the evaluation index system is shown in Table 12. As can be seen from the table, the evaluation index system consists of 6 first-level indicators and 18 second-level indicators.

Table 12: Evaluation index system

First-level indicator	Symbol	Secondary indicators	Symbol
Professional positioning adaptation	Q1	The alignment of professional training objectives with the demand for international cultural communication talents	Q11
		Professional direction setting	Q12
		The talent specification positioning meets the compound requirements of "English + culture + skills" for international communication	Q13
Curriculum system adaptation	Q2	International communication courses	Q21
		Cultural industry courses	Q22
		English skills courses	Q23
Adaptation of the teaching staff	Q3	Teachers with relevant working experience in international communication or the cultural industry	Q31
		Teachers with cross-cultural communication skills	Q32
		Teachers participating in international cultural industry communication projects	Q33
The adaptability of practical teaching	Q4	Cooperate with cultural enterprises to establish practice bases	Q41
		Students participate in international cultural communication practice projects	Q42
		The matching of practical education content with the actual job requirements for international communication of the cultural industry	Q43
The compatibility of industry-education integration	Q5	The depth of cultural enterprises and the formulation of professional talent cultivation plans	Q51
		Jointly develop international communication textbooks or teaching resources by schools and enterprises.	Q52
		Enterprise experts participate in classroom teaching	Q53
Quality feedback adaptability	Q6	The employment situation of graduates in international communication positions in the cultural industry	Q61
		Employers' views on graduates' international communication capabilities	Q62
		Graduates' views on the compatibility of professional teaching with the demands of the cultural industry	Q63

3.2 Analysis of indicator weighting results

3.2.1 Normalization of the matrix of integrated impact relationships

According to the network hierarchical analysis method, the influence relationship matrix of first-level indicators and second-level indicators in the evaluation index system is calculated respectively, and the influence relationship matrix of first-level indicators and second-level indicators is standardized, and the standardization of the comprehensive influence relationship matrix of first-level indicators is shown in Figure 1, and the standardization of the comprehensive influence relationship matrix of second-level indicators is shown in Figure 2. As can be seen from the figure, after the standardization process, the data of the first-level indicators and the second-level indicators are maintained within the range of 0.1 to 0.3.

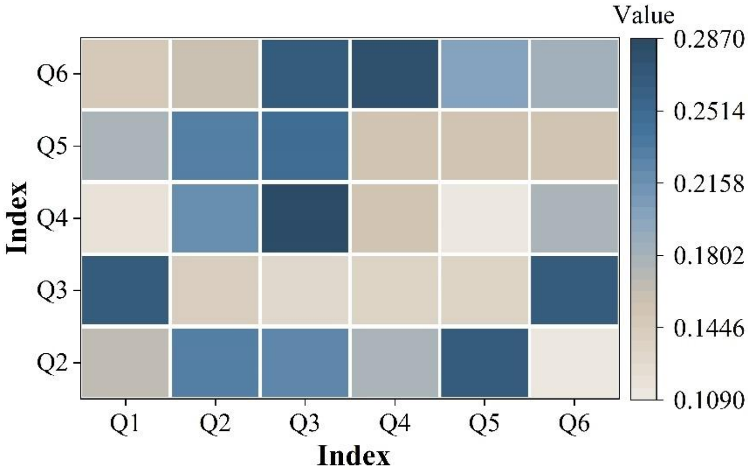

Figure 1: Standardization of the first-level indicator relationship matrix

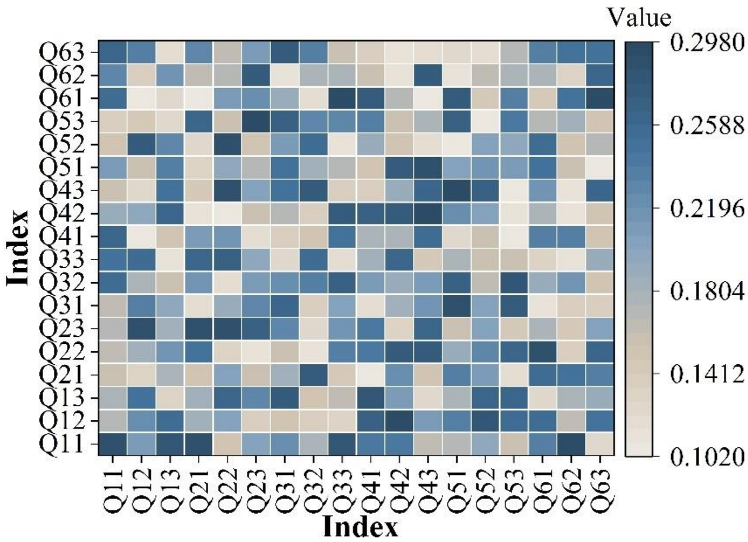

Figure 2: Standardization of the relationship matrix of secondary indicators

3.2.2 Computing Unweighted, Weighted, and Limit Supermatrices

On the basis of the influence relationship matrix of the secondary indicators, the network hierarchy analysis was used again to calculate the unweighted, weighted and limit supermatrices, respectively, and the unweighted supermatrix is shown in Fig. 3, the weighted supermatrix is shown in Fig. 4, and the limit supermatrix is shown in Fig. 5. After a series of calculations, the range of distribution of the values of the secondary indicators is 0.04 to 0.07.

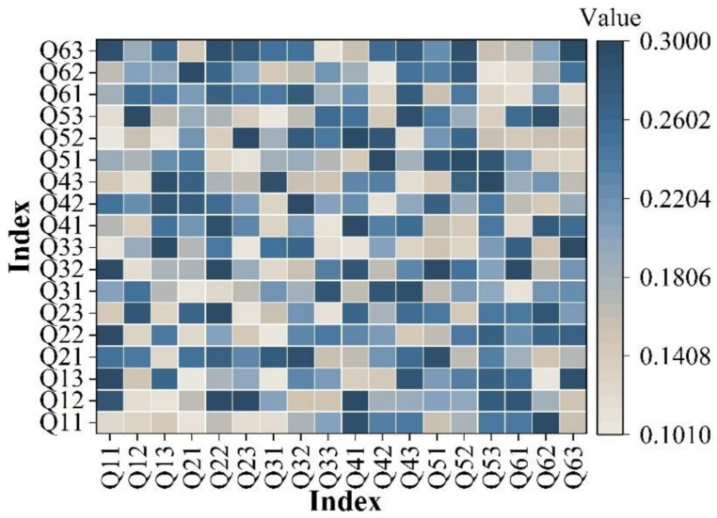

Figure 3: Unweighted super matrix

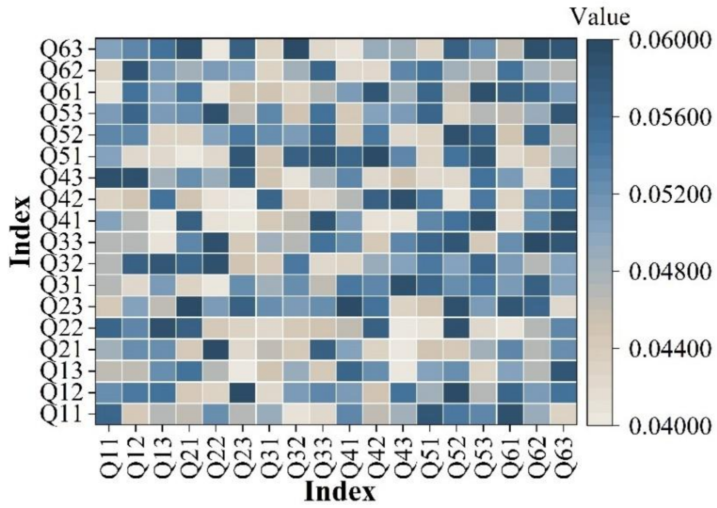

Figure 4: Weighted super matrix

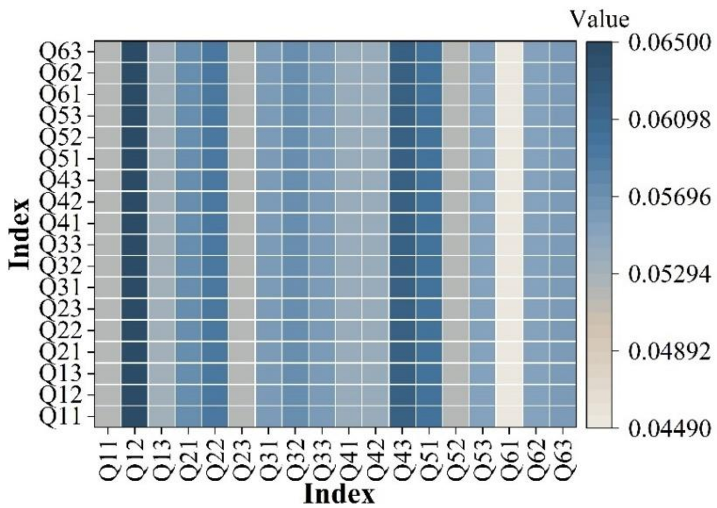

Figure 5: Extreme super matrix

3.2.3 Indicator weighting analysis

On the basis of Figure 5, the weights of the indicators are derived, and the results of the weights of the indicators are shown in Table 13. The six level 1 evaluation indicators are sorted according to the weight, and the sorting results obtained are professional positioning suitability (Q1), practical teaching suitability (Q4), faculty suitability (Q3), curriculum system suitability (Q2), industry-teaching integration suitability (Q5), and quality feedback suitability (Q6). Through observation, it can be found that the indicators of simplicity, convenience, aesthetics, and objectivity have higher weights in all the secondary evaluation indicators. In addition, in the evaluation index system of the mechanism of adapting English majors to the needs of cultural industry in higher vocational colleges and universities, the weights of professional orientation adaptation (Q1) and practical teaching adaptation (Q4) are the highest, which indicates that professional orientation adaptation (Q1) and practical teaching adaptation (Q4) have a significant impact on the mechanism of adapting English majors to the needs of cultural industry in higher vocational colleges and universities.

Table 13: Index weight result

First-level indicator	Weight	Rank	Secondary indicators	Weight	Rank
Q1	0.17	1	Q11	0.052	15
			Q12	0.065	1
			Q13	0.053	14
Q2	0.168	4	Q21	0.057	5
			Q22	0.059	4
			Q23	0.052	15
Q3	0.169	3	Q31	0.056	7
			Q32	0.057	5
			Q33	0.056	7
Q4	0.17	1	Q41	0.054	12
			Q42	0.054	12
			Q43	0.062	2
Q5	0.167	5	Q51	0.06	3
			Q52	0.052	15
			Q53	0.055	10
Q6	0.156	6	Q61	0.045	18
			Q62	0.055	10
			Q63	0.056	7

3.3 Comprehensive evaluation analysis

3.3.1 Standardized processing

According to the calculation process application of TOPSIS method, firstly, the indicator data of the selected S higher vocational colleges and universities from 2014 to 2023 are standardized, and the results of the standardized treatment are shown in Table 14. After the standardization process, the selected data are all between 0 and 1, ensuring the credibility of the final calculation results.

Table 14: Standardized processing results

Index	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Q11	0.4064	0.6773	0.7314	0.743	0.7543	0.7074	0.1809	0.442	0.5949	0.989
Q12	0.5211	0.3843	0.4035	0.7534	0.7829	0.7456	0.2194	0.3573	0.6917	0.9501
Q13	0.4644	0.4705	0.5937	0.7059	0.8457	0.7072	0.2901	0.3174	0.7619	0.9454
Q21	0.4713	0.5353	0.6511	0.5668	0.6388	0.6052	0.2324	0.3379	0.5767	0.9619
Q22	0.4101	0.4216	0.5062	0.5959	0.6236	0.5378	0.2509	0.3752	0.7402	0.9225
Q23	0.4232	0.5192	0.5456	0.6282	0.6346	0.5591	0.2177	0.3699	0.5306	0.9553
Q31	0.4581	0.5832	0.5344	0.6742	0.7401	0.6656	0.3997	0.5465	0.7134	0.9747
Q32	0.4173	0.5024	0.5604	0.6898	0.7248	0.6557	0.2871	0.5344	0.8907	0.9203
Q33	0.4432	0.5619	0.5838	0.6311	0.7356	0.6351	0.4396	0.6166	0.7943	0.9811
Q41	0.4865	0.5208	0.5457	0.6555	0.7229	0.6825	0.4005	0.6889	0.7452	0.9948
Q42	0.4769	0.565	0.6267	0.6152	0.7237	0.5149	0.3439	0.6562	0.8662	0.9918
Q43	0.4733	0.5226	0.5337	0.6622	0.7055	0.5821	0.4237	0.6355	0.8481	0.9963
Q51	0.4571	0.5098	0.5759	0.6697	0.7502	0.5769	0.4604	0.6122	0.5155	0.9451
Q52	0.4255	0.5985	0.6158	0.6536	0.6918	0.5038	0.2687	0.5903	0.7037	0.9708
Q53	0.4357	0.5527	0.6636	0.7108	0.7755	0.5499	0.2423	0.6279	0.8523	0.9977
Q61	0.3926	0.5958	0.6218	0.6474	0.7709	0.5511	0.3633	0.5841	0.7984	0.9295
Q62	0.3995	0.5292	0.6199	0.6494	0.6759	0.5151	0.2732	0.6177	0.8123	0.9962
Q63	0.4614	0.5559	0.6331	0.7497	0.7984	0.5596	0.2301	0.5485	0.7435	0.9925

3.3.2 Analysis of evaluation results

On the basis of evaluating the weights of the indicators and the results of the normalization process, a weighting matrix is constructed using the TOPSIS method, and the weighting matrix is shown in Table 15. Based on the data in the table, the positive ideal solution and negative ideal solution are determined. The details are as follows:

$$s_j^+ = \max_{1\le i\le m}\{q_{ij}\}, (j=1,2,...,18) = (0.0339, 0.0352, 0.038, 0.049, 0.0509, \\ 0.0485, 0.0276, 0.0394, 0.0526, 0.0618)$$

$$s_j^- = \min_{1\le i\le m}\{q_{ij}\}, (j=1,2,...,18) = (0.0177, 0.0249, 0.0262, 0.0291, 0.033, \\ 0.0248, 0.0094, 0.0168, 0.0276, 0.0418)$$

Then calculate the Euclidean spatial distance, relative closeness of each evaluation object to the optimal solution and the worst solution. Namely:

Euclidean spatial distance of the optimal solution:

$$Sd_i^+ = \sqrt{\sum_{j=1}^{n}(s_j^+ - q_{ij})^2}, (i=2014,...,2023) = (0.1624, 0.1035, 0.1020, 0.2141, 0.1888, \\ 0.2678, 0.1898, 0.1850, 0.2146, 0.1444)$$

The worst solution to European spatial distance:

$$Sd_i^- = \sqrt{\sum_{j=1}^{n}(s_j^- - q_{ij})^2}, (i = 2014,...,2023) = (0.1293, 0.0827, 0.1105, 0.1429, 0.1332,$$
$$0.1581, 0.1381, 0.2214, 0.2352, 0.2146)$$

Relative closeness:

$$C_i = \frac{Sd_i^-}{Sd_i^+ + Sd_i^-}, (i = 2014,...,2023) = (0.4433, 0.4443, 0.5202, 0.4003, 0.4136,$$
$$0.3712, 0.4212, 0.5448, 0.5229, 0.5979)$$

Table 15: Weighted matrix

Index	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Q11	0.0211	0.0352	0.0380	0.0386	0.0392	0.0368	0.0094	0.0230	0.0309	0.0514
Q12	0.0339	0.0250	0.0262	0.0490	0.0509	0.0485	0.0143	0.0232	0.0450	0.0618
Q13	0.0246	0.0249	0.0315	0.0374	0.0448	0.0375	0.0154	0.0168	0.0404	0.0501
Q21	0.0269	0.0305	0.0371	0.0323	0.0364	0.0345	0.0132	0.0193	0.0329	0.0548
Q22	0.0242	0.0249	0.0299	0.0352	0.0368	0.0317	0.0148	0.0221	0.0437	0.0544
Q23	0.0220	0.0270	0.0284	0.0327	0.0330	0.0291	0.0113	0.0192	0.0276	0.0497
Q31	0.0257	0.0327	0.0299	0.0378	0.0414	0.0373	0.0224	0.0306	0.0400	0.0546
Q32	0.0238	0.0286	0.0319	0.0393	0.0413	0.0374	0.0164	0.0305	0.0508	0.0525
Q33	0.0248	0.0315	0.0327	0.0353	0.0412	0.0356	0.0246	0.0345	0.0445	0.0549
Q41	0.0263	0.0281	0.0295	0.0354	0.0390	0.0369	0.0216	0.0372	0.0402	0.0537
Q42	0.0258	0.0305	0.0338	0.0332	0.0391	0.0278	0.0186	0.0354	0.0468	0.0536
Q43	0.0293	0.0324	0.0331	0.0411	0.0437	0.0361	0.0263	0.0394	0.0526	0.0618
Q51	0.0274	0.0306	0.0346	0.0402	0.0450	0.0346	0.0276	0.0367	0.0309	0.0567
Q52	0.0221	0.0311	0.0320	0.0340	0.0360	0.0262	0.0140	0.0307	0.0366	0.0505
Q53	0.0240	0.0304	0.0365	0.0391	0.0427	0.0302	0.0133	0.0345	0.0469	0.0549
Q61	0.0177	0.0268	0.0280	0.0291	0.0347	0.0248	0.0163	0.0263	0.0359	0.0418
Q62	0.0220	0.0291	0.0341	0.0357	0.0372	0.0283	0.0150	0.0340	0.0447	0.0548
Q63	0.0258	0.0311	0.0355	0.0420	0.0447	0.0313	0.0129	0.0307	0.0416	0.0556

The relative fit scores calculated above were subjected to data analysis. The statistical analysis of relative fit is presented in Table 16, where C denotes the relative fit score. Higher relative alignment values indicate greater effectiveness in the alignment mechanism between vocational colleges' English programs and cultural industry demands. The relative alignment value increased from 0.4433 to 0.5979, demonstrating that over time, the alignment mechanism between vocational colleges' English programs and cultural industry demands has matured. This enables vocational colleges to cultivate outstanding English professionals, thereby enhancing the quality of development for the cultural industry along its international communication strategy path.

Table 16: Relative progress statistics and analysis

Year	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
C	0.4433	0.4443	0.5202	0.4003	0.4136	0.3712	0.4212	0.5448	0.5229	0.5979
Rank	6	5	4	9	8	10	7	2	3	1

4 Conclusion

To enable higher vocational colleges and industries to better align with international communication strategies, a mechanism for matching the needs of vocational college English programs with cultural industries has been established. The Delphi method, online hierarchical analysis method, and advantage distance method were employed to evaluate the practical value of this matching mechanism. The relative progress value rose across the years between 2014 and 2023 as follows: 0.4433 -0.5979. It means that with the passage of time, the alignment system of English programs in vocational colleges and the requirements of the cultural industries is constantly being perfected. The successful supply of excellent English professionals to the cultural sector by vocational colleges is improving the role played by the cultural industry in contributing to the development of international communication plans.

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