

Construction of the Evaluation System of Teachers' Intercultural Competence in the Context of Local Internationalization of Higher Vocational Education Based on the Entropy Value Approach

Chang Liu *

Culture and Art School, Zhejiang Technical Institute of Economics, Hangzhou, Zhejiang, 310018, China;
zjg226@126.com

Abstract: In the process of in situ internationalization of higher vocational colleges and universities, teachers' intercultural competence has an important impact on the level of in situ internationalization of schools. This paper analyzes the development situation of in situ internationalization in higher vocational education, takes teachers' intercultural competence as an important index to measure the internationalization level of education, and uses the entropy value method to construct the evaluation model of teachers' intercultural competence. The overall level of teachers' intercultural communication ability is investigated, and the evaluation system of teachers' intercultural ability is established at different levels. The combination of hierarchical analysis and entropy value method is used to determine the combination weights of teachers' intercultural competence, combined with the overall survey level of teachers' intercultural competence, and compared with the evaluation results of experts, to verify the reasonableness of the evaluation system of teachers' intercultural competence under the development of internationalization of higher vocational colleges and universities in the field established in this paper. The overall level of teachers' intercultural competence development under the development of internationalization in the field of higher vocational education is obtained by combining the experts' scores, which is 83.25 points, at a good level, utilizing the development of internationalization in the field of education in higher vocational colleges and universities.

Keywords: hierarchical analysis method; entropy value method; combination weight; in situ internationalization; intercultural competence

1. Introduction

In July 2023, the Ministry of Education's Office issued a document requiring the accelerated advancement of key tasks in the reform of the modern vocational education system. Among these tasks, the construction of vocational schools with a high level of internationalization was identified as a priority, with a focus on both "going global" and "bringing in" initiatives to comprehensively enhance the internationalization of vocational schools. By 2025, three batches of approximately 300 vocational schools with Chinese characteristics and a high level of internationalization will be supported [1-2]. Against this backdrop, higher vocational colleges have launched a new wave of internationalization initiatives.

From a cross-cultural perspective, educational internationalization essentially involves two-way exchange and development between domestic and international education systems based on their respective philosophies, institutions, and cultural differences [3-4]. Drawing from the successful experience of Sinicizing Marxism, the optimal model for educational internationalization is the integration of "internationalization grounded in local practice and localization grounded in internationalization" [5-6]. In this process, localized internationalization is a crucial component. As a



form of educational internationalization, the core philosophy of localized internationalization focuses on implementing international talent cultivation within domestic education. The process manifests as "schools leveraging their existing international high-quality educational resources to build internationally oriented campuses with local characteristics, providing faculty and students with opportunities to engage with cross-cultural and international affairs within the campus environment [7-9]. For students, local internationalization not only enables Chinese students to receive education with international elements within their own country, enhancing their international competitiveness, but also allows international students studying in China to better adapt to the Chinese educational model and Chinese culture through participation in international courses and programs hosted by Chinese schools [10-12]. In this process, teachers, as the main actors in educational practice, directly influence the quality of education and teaching as well as students' international competitiveness through their cross-cultural competence levels, making them a key indicator of a school's level of localized internationalization [13-14]. Cross-cultural competence refers to an individual's ability to effectively and appropriately engage in communication activities in a specific cross-cultural environment. Therefore, establishing an evaluation system for teachers' cross-cultural competence not only helps understand their competence levels but also promotes the further development of internationalization in higher vocational education.

Academic circles classify the various elements of cross-cultural competence from different dimensions. In the well-established classical research paradigm, knowledge, skills, attitudes, and awareness are the four recognized key dimensions of cross-cultural competence [15-16]. Literature [17] introduces two measurement methods for cross-cultural competence modules: personality trait scales and critical incident techniques. A structural model combining the two is proposed, which can predict multiple personality traits. Literature [18] utilizes computer networks to construct a cross-cultural competence assessment model encompassing cognition, strategy, and action, which has been applied among students to enhance their cross-cultural communication skills. Literature [19] proposes a cross-cultural competence scale for pre-service teachers to assess their cross-cultural competence, covering indicators such as knowledge, teaching flexibility, proactive teacher-student interaction, and cultural empathy. Current research on evaluation systems for teachers' cross-cultural competence is relatively weak, and even more so in vocational education. It is necessary to explore comprehensive evaluation indicators in conjunction with the characteristics of vocational education (industry-education integration) and pay attention to the weights of cross-cultural competence indicators. This is because most schools only use whether teachers have overseas experience as an evaluation indicator for outstanding teachers, neglecting their actual abilities.

The entropy method is a commonly used multi-factor comprehensive evaluation method that can objectively and comprehensively evaluate teachers' cross-cultural competence. In information theory, information entropy measures the uncertainty and disorder of information [20]. In the entropy method, entropy values are calculated after standardizing the data of each indicator to reflect the contribution of each indicator to the evaluation object. Literature [21] combines the entropy value method and Bayesian methods to assess teachers' adaptability to information-based teaching, with the entropy value method primarily used to calculate teachers' teaching abilities, personal behavior, teaching environment, interpersonal interaction, and psychological adaptability. These studies provide practical references for the transferable application of teacher cross-cultural competence evaluation systems.

This paper briefly explains the connotation of in situ internationalization and the status of in situ internationalization development in higher vocational education. It proposes that teachers' intercultural competence is one of the important indicators of internationalization level, and analyzes the trend of the influence of the development of in situ internationalization in higher vocational education on teachers' intercultural competence. The evaluation index system of teachers' intercultural competence in in situ internationalization of higher vocational education is established from cognitive, emotional and behavioral levels. The evaluation indexes are processed dimensionlessly, and the weights of the evaluation indexes of teachers' intercultural competence are determined by combining the overall level of teachers' intercultural communicative competence researched. A comprehensive analysis of teachers' intercultural competence is carried out using the AHP-entropy value method, and the expert evaluation results are used to realize the verification of the evaluation system of teachers' intercultural competence.

2. Foundations of the Evaluation System

2.1. Local Internationalization

Local internationalization refers to the fact that, in the context of the increasingly obvious international governance of higher education, colleges and universities make use of the existing international high-quality educational resources, including international scholars, international students, foreign teaching materials, cross-border projects, diversified curricula and international conferences, etc.,

to build international campuses rich in local characteristics, and to provide opportunities for all students to come into contact with cross-cultural and international things on campus, so as to achieve the goal of cultivating high-level internationalized talents. This paper suggests that local internationalization should include the following

This paper argues that local internationalization should include the following key elements: an internationalization philosophy that pursues educational equity, broad coverage of all teachers and students in the local school, culturally sensitive internationalized teaching, enhancement of the depth and breadth of students' internationalized learning experience, increase of cultural diversity on campus, and enhancement of the organization's capacity for internationalized development and governance.

2.2. Internationalization of Higher Vocational Education in the Field

(1) There is an imbalance between "policy orientation" and "strategic planning" of international design

In the current field of internationalization of higher vocational education, "cross-border internationalization" is still dominant, while "local internationalization" is marginalized, which is mainly manifested in the relevant policies and development plans from the central government to local governments, and "going out" and "opening up" are the mainstream keywords.

Under the macro policy guidance of "cross-border mobility", the strategic planning of "local internationalization" is almost absent, and the practical exploration of "local internationalization" lacks corresponding platforms and institutional support [22].

(2) There is an imbalance between the "depth of integration" and the "effectiveness of implementation" of international courses

Curriculum internationalization is the core of local internationalization of higher vocational education, and is crucial to enhancing students' international outlook and vocational ability.

The degree of internationalization of the professional curriculum has yet to be strengthened, and the curriculum system and teaching content that are closely aligned with international standards are still insufficient, resulting in a disconnect between the content of education and global development trends. The coverage of the internationalized courses is limited, failing to benefit all students and restricted to specific groups, which affects the fairness of education. The degree of integration and innovation of the content of internationalized curricula needs to be improved. Some of the curricula have simply transplanted foreign teaching materials to the neglect of local conditions and school-based characteristics, and there is a lack of in-depth integration of foreign teaching materials with local teaching materials and localized innovation. In addition, the construction of internationalized courses has the phenomenon of duplication of investment and waste of resources, and often focuses on construction but not implementation, and lacks systematic and standardized design of course system, which makes it difficult to guarantee the implementation effect of internationalized courses, and the evaluation and continuous improvement of teaching quality are facing difficulties.

(3) There is an imbalance between the "depth of intelligence introduction" and the "effectiveness of internal training" of international teachers

At present, higher vocational colleges usually adopt the dual-track strategy of "intelligence introduction" and "internal training" to build an international teaching team. The introduction of intelligence refers to the recruitment of foreign teachers and talents who have returned from studying abroad, while internal training focuses on improving the professional quality and teaching ability of existing teachers. However, compared with undergraduate colleges, the attractiveness of higher vocational colleges in terms of scientific research support platforms and salary packages is relatively weak, resulting in the inability to truly implement the "intelligence introduction" strategy, and the quality of the international talents introduced is uneven, making it difficult to attract real industry teachers and craftsmen.

2.3. Teachers' Intercultural Competence

2.3.1. Key Indicators of the Level of Internationalization of Education

As an important indicator of the level of internationalization of education, teachers' intercultural competence plays an important role in the process of local internationalization of higher vocational colleges and universities [23].

As a form of internationalization of education, the concept of local internationalization of education focuses on the implementation of international talent cultivation in local education, and the process of internationalization of education is expressed in the following way: "Schools make use of the existing international quality educational resources to build international campuses rich in local characteristics, and provide opportunities for teachers and students to come into contact with cross-cultural and

international affairs within the school". The process of "building an international campus with local characteristics by utilizing the school's existing international quality educational resources to provide opportunities for teachers and students to be exposed to intercultural and international affairs within the school.

To integrate international education into the local educational environment, local internationalization is mainly carried out in the following ways: First, to offer intercultural communication courses or introduce international cases and materials. Second, hiring foreign teachers and recruiting international students. Third, providing international training and exchanges for local teachers and students. Fourth, organizing international student exchange programs on campus. Fifth, to cooperate with overseas educational and research institutions to carry out programs on our campus. Sixth, organizing events such as the Campus International Cultural Festival.

For students, local internationalization not only enables national students to receive an education with international elements in their home country, enhancing their international competitiveness. It also enables foreign students to better adapt to the education model and culture by participating in international courses and programs hosted on campus.

In this process, teachers, as the main body of educational practice, whose level of intercultural competence directly affects the quality of education and teaching and the international competitiveness of students, are an important indicator of the level of in situ internationalization in schools.

2.3.2. The Impact of Local Internationalization of Higher Education Institutions on Teachers' Intercultural Competence

Intercultural competence is an individual's ability to effectively and appropriately accomplish communicative activities in a specific intercultural environment. Academics classify various elements of intercultural competence in different dimensions, and in the well-established classical research paradigm, knowledge, skills, attitudes and awareness are the four recognized key dimensions of intercultural competence.

In the following, we analyze how in situ internationalization policies and activities in higher education institutions affect teachers' intercultural competence performance from the four dimensions of knowledge, skills, attitudes and awareness respectively.

(1) Intercultural Thematic Training

From the cross-cultural knowledge dimension, lecturers with rich cross-cultural knowledge reserves are able to incorporate elements from different cultures into their teaching content to enhance the diversity and depth of the teaching content.

Increasing teachers' intercultural knowledge reserves not only requires teachers' own efforts, but also requires higher vocational colleges to provide corresponding training.

(2) Internationalized Teaching Activities

From the dimension of cross-cultural skills, lecturers with good cross-cultural skills are able to resolve cross-cultural conflicts they face when communicating with foreign teachers and students through reasonable explanations, negotiation and mediation, avoiding misunderstandings and communication barriers, and enabling them to design and implement teaching strategies suitable for multicultural groups. By considering each other's cultural differences when dealing with foreign teachers and students, teachers can more effectively engage foreign teachers and students and improve teaching effectiveness.

(3) International Cultural Activities on Campus

From the dimension of cross-cultural awareness, lecturers with sensitive cross-cultural awareness can effectively recognize different cultural traditions and values. And from the dimension of intercultural attitudes, teachers with inclusive intercultural attitudes tend to create a positive communication environment, encourage students to respect and understand these differences, and promote internationalized communication. Intercultural awareness and attitudes can be acquired not only through explicit ways such as teacher training, but also through implicit ways such as creating an atmosphere of an internationalized campus environment in our school.

2.4. Methodology for Constructing a Model for Evaluating Teachers' Intercultural Competence

Entropy value method is a widely used, highly recognized and objective method of assignment, which is based on the concept of information entropy and determines the weight of indicators by calculating the information entropy of each indicator [24-25]. The specific calculation steps are as follows.

In the first step, the establishment of the initial data matrix Xx is carried out according to formula

(1). i.e.,:

$$Xx = \begin{bmatrix} x_{11} & x_{12} & \cdots & x_{1m} \\ x_{21} & x_{22} & \cdots & x_{2m} \\ \vdots & \vdots & \cdots & \vdots \\ x_{n1} & x_{n2} & \cdots & x_{nm} \end{bmatrix} \quad (1)$$

In the second step, the data were standardized to solve the problem of differences in the data scale. For positive indicators are standardized according to equation (2). Namely:

$$x'_{ij} = \frac{x_{ij} - x_j^{\min}}{x_j^{\max} - x_j^{\min}} \quad (2)$$

For the reverse indicators are normalized according to equation (3). Namely:

$$x'_{ij} = \frac{x_j^{\max} - x_{ij}}{x_j^{\max} - x_j^{\min}} \quad (3)$$

In the third step, after the dimensionless processing there may be a situation that some values may be zero, therefore, in order to make the data operation meaningful, the dimensionless data will be non-negative leveled, that is, $x'_{ij} = x_{ij} + H$. Where H is the magnitude of the indicator panning, which is taken as 0.0001 in this paper. i.e.,:

$$x''_{ij} = x'_{ij} + H \quad (4)$$

In the fourth step, the data are normalized after the unification of the scale. To wit:

$$y_{ij} = \frac{x''_{ij}}{\sum_{i=1}^n x''_{ij}} \quad (5)$$

Step 5: Calculate the entropy value of the j th indicator. i.e.,:

$$e_j = -\frac{1}{\ln n} \sum_{i=1}^n y_{ij} \ln y_{ij} \quad (6)$$

Step 6: Calculate the coefficient of variation for the j th indicator as:

$$g_j = 1 - e_j \quad (7)$$

Step 7: Calculate the weight coefficient of each indicator with the following formula:

$$w_j = \frac{g_j}{\sum_{j=1}^p g_j} \quad (8)$$

3. Evaluation of Teachers' Intercultural Competence Based on the AHP-Entropy Method

3.1. Indicators for Evaluating Teachers' Intercultural Competence

The survey was conducted for teachers of higher vocational colleges and universities directly under the capital city of Province X. A total of 196 questionnaires were distributed and 182 were retrieved.

Before analyzing the data, the function COUNTIF is used to count the number of points scored by the respondents of the questionnaire, and if the score is too concentrated on one or two points, it is regarded as an unreasonable answer sheet. After counting a total of 10 unreasonable answer sheets were removed, and the valid answer sheets were 172.

After completing the data screening, the data of the test were statistically and analytically analyzed

using SPSS 25.0 software.

3.1.1. Overall Level of Teachers' Intercultural Communication Skills

The overall intercultural communication competence of higher vocational teachers and the level of each module are shown in Table 1.

From the data in the table, the overall intercultural communication competence of teachers in higher vocational colleges and universities is relatively satisfactory, with an overall mean value of 4.08 (out of 5), and the mean value of the five modules is greater than 3.8. The awareness part is the highest (4.36), and the discovery and interaction skills part is the lowest (3.85). The specific ranking is, awareness > attitude > interpretation, association skills > knowledge > discovery, interaction skills.

From the data, it can be seen that awareness and attitude are significantly higher than the other three, indicating that teachers in higher vocational colleges and universities have positive attitudes and high awareness of intercultural communication, but knowledge and skills, especially discovery and interaction skills, need to be strengthened.

Table 1. Teachers' cross-cultural ability and the level of each module.

	Case number	Proportion	Mean	SD	F	p
Q1/Attitude	34	0.20	4.15	0.097	72.574	0.001
Q2/Consciousness	43	0.25	4.36	0.154		
Q3/Knowledge	37	0.22	3.92	0.193		
Q4/Discovery, interactive skills	28	0.16	3.85	0.122		
Q5/Interpretation, related skills	30	0.17	4.11	0.091		
Total	172	1.00	4.08	0.328		

The *t*-test of the effect of overseas experience on teachers' intercultural communicative competence in higher vocational colleges is shown in Table 2.

According to the data in the table, there is no significant difference in the effect of having or not having overseas experience on the dimensions of teachers' intercultural communicative competence.

Table 2. Overseas experience tests on the impact of teachers' cross-cultural ability.

		Levine variance equivalent		Average equivalent t test						
		F	Sig	t	freedom	Sig. (double tail)	Mean	Standard error	Differential value	
Q1	Assumed equal variance	0.354	0.717	0.075	205	0.912	0.025	0.235	-0.481	0.563
	Unassuming equal variance			0.084	8.632	0.953	0.027	0.219	-0.523	0.597
Q2	Assumed equal variance	0.473	0.559	-0.893	205	0.524	0.029	0.299	-0.874	0.425
	Unassuming equal variance			-0.811	9.004	0.537	0.031	0.278	-0.893	0.463
Q3	Assumed equal variance	0.056	0.842	-0.439	205	0.672	0.043	0.356	-0.842	0.542
	Unassuming equal variance			-0.457	7.263	0.691	0.047	0.367	-8.215	0.689
Q4	Assumed equal variance	3.249	0.512	-0.293	205	0.854	0.055	0.293	-0.614	0.415
	Unassuming equal variance			-0.663	8.429	0.726	0.061	0.192	-0.487	0.352
Q5	Assumed equal variance	0.619	0.385	-0.415	205	0.727	0.091	0.325	-0.727	0.585
	Unassuming equal variance			-0.337	7.334	0.767	0.094	0.267	-0.684	0.493
Total	Assumed equal	0.893	0.471	-0.511	205	0.652	0.097	0.236	-0.526	0.345

	variance									
	Unassuming equal variance	/	/	-0.728	8.713	0.676	0.102	0.185	-0.513	0.321

The overall situation of the influence of overseas experience on teachers' intercultural communicative competence in higher vocational colleges and universities is shown in Fig. 1, as shown in the figure, the mean values of teachers with overseas experience on all dimensions of intercultural communicative competence are higher than those of teachers without overseas experience.

Overseas experience is a very valuable experience for teachers' intercultural communicative competence. Going abroad is a direct experience of foreign cultures and cultural differences as well as intercultural communication, which are direct experiences that cannot be replaced by book knowledge and training.

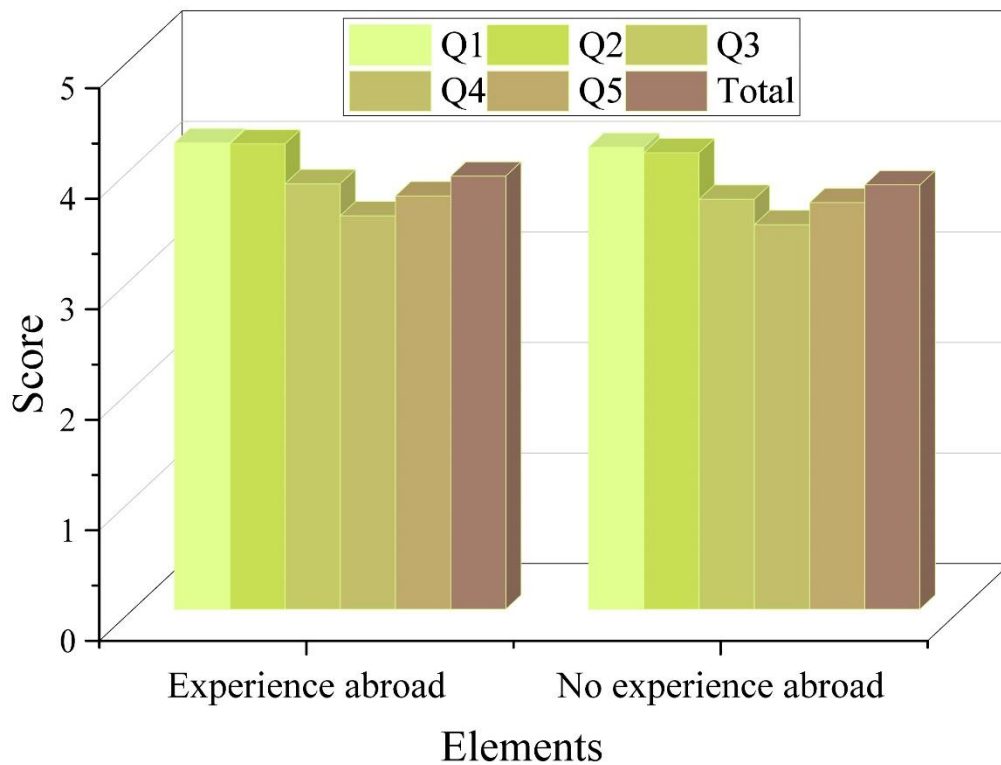


Figure 1. The overall situation of the impact of overseas experience on capacity.

3.1.2. Evaluation System

Combining the connotation and development requirements of intercultural communication competence, this paper proposes the following evaluation indexes of teachers' intercultural communication competence under the internationalization of higher vocational colleges and universities and the development requirements of teachers' intercultural communication competence in the field of education. The evaluation indexes of teachers' intercultural communication competence are shown in Table 3, which are mainly composed of four dimensions: cognitive level, emotional level, behavioral level, and teachers' moral quality.

Table 3. The evaluation index of teachers' cross-cultural communication ability.

The evaluation index of teachers' cross-cultural communication ability	Index	Description item
	Cognitive level	Cultural knowledge
		Language knowledge
		Professional knowledge/expertise
	Affective level	Inclusiveness
		Open

		Confidence
		Initiative
	Behavioral level (cross-cultural teaching ability)	Classroom organization ability
		Classroom management
		Classroom conflict capability
		Communication ability
		Modern education technical ability
		General knowledge and skills
		Teacher ethics
	Love student	
	No discrimination	

3.1.3. Selection of Dimensionless Treatments for Evaluation Indicators

Dimensionless processing is through the mathematical transformation of indicators of different outlines for standardization, to eliminate the influence of the outline, to ensure that the original indicators have comparability after the transformation.

In this paper, the index of dimensionless processing uses the method of great and small values, and the conventional method of the opposite number is used for moderate indicators. The specific formula is as follows:

$$X'_{ij} = \frac{X_{ij} - \min \{x_{ij}, \wedge, x_{nj}\}}{\max \{x_{ij}, \wedge, x_{nj}\} - \min \{x_{ij}, \wedge, x_{nj}\}} \quad (9)$$

where X'_{ij} is the value of the processed positive indicator, $\max \{x_{ij}, \wedge, x_{nj}\}$ denotes the maximum value of the indicator in the i th, and $\min \{x_{ij}, \wedge, x_{nj}\}$ denotes the minimum value among the i th indicator. i.e.,:

$$X'_{ij} = -|X_{ij} - k| \quad (10)$$

where X'_{ij} is the value of the X_{ij} processed fitness indicator, and k inside the absolute value is the fitness value of X_{ij} in the fitness indicator. i.e.,:

$$X''_{ij} = X'_{ij} + n \quad (11)$$

After the processing of data dimensionless, the processed data may appear negative numbers and 0, which will make the calculation results meaningless, to eliminate the impact of negative numbers and 0, can be used after the standardization of data processing in the way of translation, which n is expressed by the translation unit, the value of this number is often taken by the minimum value of the data after the dimensionless decision.

3.2. Determine Indicator Weights Using AHP-Entropy Method

3.2.1. Selection of the AHP-Entropy Method

The following are the calculation steps of the hierarchical analysis method, which are as follows:

STEP1: Establishing a recursive hierarchy model

The decision goal and decision object to be analyzed establish a recursive hierarchy, the goal level refers to the purpose of the decision, the criterion level is the factors to be considered, and the solution level is the object of the decision.

STEP2: Construct judgment matrix for two-by-two comparison

When programs are compared, they are rated according to their importance, giving nine levels of importance and their assigned values. The matrix formed from the two-by-two comparison results is called the judgment matrix. a_{ij} is the result of comparing the importance of factor i and factor j . The relative importance of a_i to a_j is usually a_{ij} expressed by a scale value, which ranges from 1,2,...,9 and its reciprocal. The meanings of the scalar values are shown in Table 4.

Table 4. Scale value.

Scale(a_{ij})	Define(Comparison factors i and j)
1	The factor i is as important as the factor j.
3	The factor i and the factor j ratio, factor i is slightly important.
5	The factor i and the factor j ratio, factor i is more important
7	It is important to represent factor i and factor j ratio.
9	The factor i and the factor j ratio, factor i is absolutely important.
2, 4, 6, 8	The median of the above judgment.
Reciprocal	Factor i and j compare, The value of the judgment is $a_{ij} = 1/a_{ji}$.

By comparing the degree of importance of each element to the elements in the previous level, the degree of importance is expressed in a specific numerical value, which is called constructing a judgment matrix. For example, if the element in the previous level is B_k , and the elements in the next level are A_1, A_2, \dots, A_n , then it is the case that using B_k as a criterion, it is the case that A_i is compared with A_j to see which of the two elements has a greater influence on B_k , and the judgment matrix constructed from this is shown in Table 5.

Table 5. General form of judgment matrix.

B_k	A_1	A_n
A_1	A_{11}	A_{1n}
A_2	A_{21}	A_{2n}
.....
A_n	A_{n1}	A_{nn}

STEP3: Normalization process to find the largest feature root λ_{\max} and feature vector W Normalize each column element using the sum-product method:

$$\bar{a}_{ij} = \frac{a_{ij}}{\sum_{k=1}^n a_{kj}} \quad (i = 1, 2, \dots, n) \quad (12)$$

Sum the normalized judgment matrices by rows:

$$A_i = \sum_{j=1}^n \bar{a}_{ij} \quad (i = 1, 2, \dots, n) \quad (13)$$

Take the normalized judgment matrix $A = (A_1, A_2, \dots, A_n)^t$ to find the eigenvector W_i :

$$W_i = \frac{A_i}{\sum_{j=1}^n A_j} \quad (14)$$

STEP4: Consistency test

In order to prevent the judgment results from being invalid due to subjective factors in the actual operation process, it is necessary to conduct a consistency test on the results, and the test process is as follows. Namely:

$$CI = \frac{\lambda_{\max} - n}{n - 1} \quad (15)$$

To measure the magnitude of CI , the random consistency indicator RI was introduced:

$$RI = \frac{CI_1 + CI_2 + \cdots + CI_n}{n} \quad (16)$$

RI is the average stochastic consistency indicator against the order of the judgment matrix, and the values of RI are shown in Table 6.

Table 6. RI order comparison table.

Order number	1	2	3	4	5	6	7	8	9
RI value	0	0	0.55	0.73	1.14	1.23	1.34	1.38	1.45

Considering that deviations from consistency may be due to random causes, when testing whether the judgment matrix has satisfactory consistency, it is also necessary to compare CI with the random consistency indicator RI to derive the test coefficient CR , with the following formula:

$$CR = \frac{CI}{RI} \quad (17)$$

Only if the result calculated by CR is less than 0.1, it indicates that the judgment matrix is consistent, that is, the weights are reasonable, and if it is not consistent then it needs to be reconstructed until it conforms to the result.

The steps of entropy value method are as follows:

Step1: Dimensionless processing of evaluation index data, as described in the previous section. After the dimensionless and standardized processing can get a new matrix, assuming that the original matrix is X , then the new matrix is X' , that is, there is $X' = (X'_{ij})_{n \times m}$, the matrix is as follows:

$$X' = \begin{bmatrix} X'_{11} & X'_{12} & \cdots & X'_{1m} \\ X'_{21} & X'_{22} & \cdots & X'_{2m} \\ \vdots & \vdots & \cdots & \vdots \\ X'_{n1} & X'_{n2} & \cdots & X'_{nm} \end{bmatrix} \quad (18)$$

Step2: Calculate the information entropy of the indicator:

$$E_j = -K \sum_{i=1}^m X'_{ij} \ln(X'_{ij}) \quad (i = 1, 2, \dots, m; j = 1, 2, \dots, n) \quad (19)$$

where the constant $K = 1 / \ln(m)$, m denotes the number of programs evaluated, and

$$X'_{ij} = \frac{X'_{ij}}{\sum_j^n X'_{ij}}$$

denotes that it is a normalization to the above indicators.

Step3: Calculate the coefficient of variation:

$$D_j = 1 - E_j \quad (20)$$

Step4: Calculate the weights:

$$W_j = \frac{d_j}{\sum_{j=1}^m d_j} \quad (21)$$

The most important feature of the entropy value method is that it directly uses the information given by the decision matrix to calculate the weights without introducing the subjective judgment of the decision maker.

The combination of AHP-entropy value method determines the weights as follows:

In this paper, based on the weight W_i calculated by AHP and the weight W_j determined by entropy value method, the combined weights of the two methods are averaged and the formula is as follows.

$$W = \frac{W_i + W_j}{2} (i = 1, 2, \dots, n, j = 1, 2, \dots, n) \quad (22)$$

3.2.2. Integrated Evaluation Methodology

In order to have a comprehensive evaluation of teachers' intercultural competence under the development of internationalization of higher vocational colleges and universities' education in the field, this paper needs to judge the comprehensive impact of higher vocational colleges and universities' education competence and so on on teachers' intercultural competence, in addition to evaluating the specific indexes of higher vocational colleges and universities' education in the field. This paper adopts the linear weighting method to make a comprehensive analysis of the evaluation of teachers' intercultural competence under the internationalized development of higher vocational colleges and universities' education in the field.

$$Z = \sum w_i x_i \quad (23)$$

Z denotes the comprehensive evaluation score, W_i is the weight value of each indicator, and X_i is the score of each indicator.

3.2.3. Final Weights

(1) First-level indicators

After the arithmetic processing of AHP-entropy value method, the weight distribution of the first-level indexes of teachers' intercultural communication competence under the development of internationalization of higher vocational colleges and universities in the field is obtained.

The weight distribution of the first-level indicators of teachers' intercultural competence is shown in Table 7.

Table 7. The primary index weight distribution of teachers' cross-cultural ability.

Primary indicator	AHP weighting	Entropy weighting	Composite weight
Cognitive level	0.315	0.274	0.302
Affective level	0.246	0.283	0.279
Behavioral level (cross-cultural teaching ability)	0.213	0.256	0.246
Teacher ethics	0.226	0.187	0.173

(2) Secondary indicators

The combined weight distribution of the secondary indicators is shown in Table 8.

Table 8. The combination weight distribution of the secondary index.

Cultural knowledge	AHP weighting	Entropy weighting	Composite weight
Language knowledge	0.105	0.093	0.097
Professional knowledge/expertise	0.074	0.083	0.081
Inclusiveness	0.082	0.094	0.093

Open	0.043	0.061	0.055
Confidence	0.076	0.043	0.049
Initiative	0.055	0.015	0.046
Classroom organization ability	0.036	0.041	0.042
Classroom management	0.121	0.107	0.115
Classroom conflict capability	0.113	0.097	0.103
Communication ability	0.052	0.062	0.061
Modern education technical ability	0.043	0.048	0.038
General knowledge and skills	0.041	0.059	0.046
Respect students	0.063	0.064	0.052
Love student	0.051	0.071	0.067
No discrimination	0.045	0.062	0.055

3.3. Application of the Evaluation System for Teachers' Intercultural Competence

Based on the qualitative and quantitative evaluation criteria, the study draws the expert rating scale of teachers' intercultural communication competence with reference to the relevant data of teachers' intercultural communication competence evaluation. Experts in related fields were selected to conduct comprehensive evaluation, and the evaluation data were counted, weighted, analyzed and summarized to obtain the expert rating scale. Due to space limitations, only some of the index scores are presented, and the summary of the expert scores of teachers' intercultural communication competence is shown in Table 9.

The study categorized the results of the indicator ratings into four grades, i.e., 60-69 as weak, 70-79 as average, 80-89 as good, and 90-100 as excellent. The selected indicators are positive type indicators, the larger the value the better. As determined by the experts' comprehensive rating, the comprehensive rating of the school's teachers' intercultural communication competence was 83.25, with an overall rating of good.

Table 9. The results of teachers' cross-cultural communication ability experts score.

Evaluation index	Scoring	Evaluation index	Scoring
Language knowledge	86.24	Classroom conflict capability	83.57
Professional knowledge/expertise	83.66	Communication ability	79.19
Inclusiveness	79.25	Modern education technical ability	89.36
Open	74.91	General knowledge and skills	81.02
Confidence	82.09	Respect students	89.24
Initiative	89.45	Love student	82.76
Classroom organization ability	83.26	No discrimination	85.15
Classroom management	79.54	/	/
Comprehensive score			83.25

4. Conclusion

This paper analyzes the needs of teachers' intercultural competence under the development of local internationalization in higher vocational colleges and universities, and constructs the evaluation system of teachers' intercultural competence under the development of local internationalization from the cognitive level, the emotional level, the behavioral level, and the teachers' ethical quality. The AHP-entropy method is used to find out the weights of each index, and the overall level of teachers' intercultural competence under the development of local internationalization in higher vocational education is obtained by combining with the evaluation of experts.

The AHP-entropy method is used to find out the weights of the first-level indicator combinations of teachers' intercultural competence under the development of internationalization in the field of higher vocational education, which are cognitive level (0.302), emotional level (0.279), behavioral level (0.246), and teachers' ethical quality (0.173). Under the requirement of internationalized development of the ground, the intercultural competence of teachers focuses more on the cognitive ability and emotional communication ability of teachers on multiculturalism.

Funding

This research was supported by the General Project of Research Program for Zhejiang Provincial Office for Education Science Planning in 2024: “Research on the Path to Enhance Intercultural Competence of Higher Vocational Teachers Based on Internationalization at Home” (2024SCG306); Major Humanities and Social Sciences Research Projects in Zhejiang higher education institutions: Research on the Practical Value and Path Choice of Internationalization at Home of Vocational Education (Grant/Award Number: 2020GH070).

References

1. Zong, C. (2024). The internationalization of China's vocational education: Value implications, practices and planning. *Vocation, Technology & Education*, 1(3).
2. Hu, L. (2024). International Cooperation and Exchange Mechanism of Vocational Education under the Background of Globalization. *International Journal of New Developments in Education*, 6(3).
3. De Wit, H. (2019). Internationalization in higher education, a critical review. *SFU educational Review*, 12(3), 9-17.
4. Buckner, E. (2019). The internationalization of higher education: National interpretations of a global model. *Comparative Education Review*, 63(3), 315-336.
5. Hu, C. (2020). Constructing the Localization of Marxism in Teaching. *Lifelong Education*, 9(3), 69-72.
6. Qu, L., & Dai, Y. (2025). Globalization, glocalization, and Internationalization at Home from a Chinese perspective: case studies of China–Europe higher education cooperation. *Research in Comparative and International Education*, 17454999251325120.
7. Kuprina, T., Maltseva, A., & Petrikova, A. (2020). The method of educational programs localization under internationalization of academic environment. *J. Lang. Cult. Educ*, 8, 146-156.
8. Li, J., & Xue, E. (2022). Stakeholders’ perspectives on implementing “internationalization at home” for China’s international education sustainability: Challenges and strategies. *Sustainability*, 15(1), 247.
9. Feng, L., & Shi, G. (2018). Local university research on local internationalization. *International Journal of Information and Education Technology*, 8(3), 246-247.
10. Alipour, M., & Abbāsi, E. (2022). Threats and opportunities for internationalization and localization of the curricula in Iran's education system in the last two decades and proposing the solutions. *Journal of Educational Innovations*, 21(1), 47-70.
11. Hu, C. C., & Lin, C. T. (2022). Internationalization and Localization of School Collaboration Models: Theory, Research and Practice. *Journal of Education Research*, (342), 48-61.
12. Gao, Q. (2024). Research on Local Internationalization of Higher Vocational Education: Literature Review and Research Perspectives. *ICCCM Journal of Social Sciences and Humanities*, 3(6), 8-22.
13. Yang, W., & Zhong, R. (2024). Internationalization of Curriculum: Developing Cross-Cultural Competence in Teacher Education Programs through Service Learning. *Eurasian Journal of Educational Research (EJER)*, (111).
14. Sukmayadi, Y., Rodgers, A., Masunah, J., Karyono, T., & Maas, G. (2022). Exploring Cross-Cultural Components in International Teacher Education Programs to Build Competenc (ies) for Indonesia. *Sociology*, 12(3), 99-109.
15. Li, M. (2020). An examination of two major constructs of cross-cultural competence: Cultural intelligence and intercultural competence. *Personality and individual differences*, 164, 110105.
16. Yashnyk, S., & Turitsyna, O. (2023). The structure of cross-cultural competence and levels of its formation. *Scientific journal «International Journal of Philology»*, 14(1), 103-111.
17. Bartel-Radic, A., & Giannelloni, J. L. (2017). A renewed perspective on the measurement of cross-cultural competence: An approach through personality traits and cross-cultural knowledge. *European management journal*, 35(5), 632-644.
18. Lin, Y. (2024). Construction of Cross-cultural Ability Evaluation Model Based on Computer Network. *Procedia Computer Science*, 247, 696-702.
19. Tudayan, J. L. P., Ogoy, J. I. N., & Pangngay, J. J. (2023). Developing a Cross-Cultural Competence Scale for Pre-Service Teachers: A Filipino Case Study. *Philippine Social Science Journal*, 6(4), 43-50.
20. Bulut, F. (2017). Different mathematical models for entropy in information theory. *Bilge International Journal of Science and Technology Research*, 1(2), 167-174.
21. Jianjiang, Z., Zhongqiang, Z., & Yan, L. (2019, May). Adaptability Performance Evaluation of University Teachers’ informatization Teaching based on Entropy Weight Bayesian Method. In 2019 IEEE 8th Joint International Information Technology and Artificial Intelligence Conference (ITAIC) (pp. 1191-1195). IEEE.
22. Pan Hezhe. (2025). Research on New Teaching Strategies for Environmental Art Design Majors in Higher Vocational Colleges under the Perspective of Mass Entrepreneurship and Innovation. *Education Reform and Development*, 7(3), 94-100.
23. Einat Doron, Dariusz Walkowiak, Rivka Tuval Mashiach, Sławomir Tobis & Jan Domaradzki. (2025). The Cross-Cultural Competencies and Attitudes Toward Ultraorthodox Clients Among Secular Therapists in Israel: An Explanatory Study. *Healthcare*, 13(10), 1210-1210.
24. Alireza Zirak. (2025). XIRAC: an optimized product-oriented near-real-time operating system with unlimited tasks and an innovative programming paradigm based on the maximum entropy method. *Frontiers of Information Technology & Electronic Engineering*, 26(4), 568-587.

25. Amir Ghahremanian, Abbas Ahmadi, Hamid Toranjzar, Javad Varvani & Nourollah Abdi. (2025). Ecological and Statistical Evaluation of Genetic Algorithm (GARP), Maximum Entropy Method, and Logistic Regression in Predicting Spatial Distribution of Astragalus sp.. *Scientifica*,2025(1),4003408-4003408.