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Exploring the Impact of Teaching Communication in Chinese as a Foreign Language on the Perception of Chinese Corporate Image

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Abstract

Considering the social, emotional, environmental, physiological and psychological dimensions of Chinese language learners, we establish a label library of learning behaviors of Chinese as a foreign language, and propose a clustering algorithm of learning behaviors based on fuzzy C-means. Consistency reliability measures are determined through reliability analysis. Combined with structural equation modeling, 12 observational variables are established with knowledge base, cognitive ability and psychological characteristics as latent variables, and four hypotheses are proposed for the influence of Chinese as a foreign language teaching communication on the perception of Chinese corporate image. The results verify the validity of the model, and the non-assignment fit indices and comparative fit indices of knowledge base of Chinese as a foreign language, cognitive ability and psychological characteristics are all greater than 0.9, which show a significant positive effect of teaching communication in Chinese as a foreign language on the perception of Chinese corporate image.

Keywords: *fuzzy C-means, clustering algorithm, confidence analysis, teaching Chinese as a foreign language, Chinese corporate image*

Introduction

In the context of globalization, China is paying more and more attention to the teaching and dissemination of Chinese as a foreign language in order to enhance the ability of international communication and cooperation (Gong, Gao, & Lyu, 2020; Li, Valcke, Dessein, Badan, & Anderl, 2021). The influence of the communication of teaching Chinese as a foreign language on the perception of Chinese enterprises' image is an important and yet to be researched issue. Through in-depth investigation of its influence mechanism and path of action, it can provide Chinese enterprises with more effective suggestions for foreign exchange and cooperation (Jin, Mercer, Babic, & Mairitsch, 2021; Tong & Tsung, 2020). Nowadays, more and more Chinese enterprises go abroad to trade and cooperate with other countries and regions. In this process, the image and perception of Chinese enterprises will directly affect business cooperation and partners' evaluation of them (Cuadrado, Lim, Alcontin, Calang, & Jumawan, 2019). Studying the impact of teaching communication of Chinese as a foreign language on the image of Chinese enterprises can help to comprehensively recognize the importance of Chinese language education for Chinese enterprises and provide theoretical and practical support for Chinese enterprises to shape a good image (Alakkas, Vivek, Paul, Nabi, & Khan, 2022; Xu & Knijnik, 2021). Secondly, the communication of teaching Chinese as a foreign language involves the intersection and integration of several disciplinary fields, which is the combination of language education and cultural communication, while the perception of Chinese corporate image is the intersection of corporate image shaping and external communication (Hung, Lin, & Wu, 2021).

Strengthening the international influence and competitiveness of Chinese enterprises and contributing to a better image of Chinese enterprises in the international arena (Hong & Yue-Jun, 2021). With the depth of research and the development of academia, scholars have begun to study the influence of individual

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cognitive difference influencing factors on the perception of Chinese corporate image from more dimensions (Freyhof & Yoğurtçuoğlu, 2020; Lyu, Lai, Lin, & Gong, 2021).

In the study of Fang, N, (Fang, 2021) it is pointed out that the psychological impact of intermediate and advanced film and television works in teaching Chinese as a foreign language, to understand the basic situation of intermediate and advanced film and television works in teaching Chinese as a foreign language, as well as the impact on Chinese language teaching before and after the use of the comparative situation. Jaekel, N et al.'s (Jaekel, Schurig, van Ackern, & Ritter, 2022) study China investigated the receptive abilities of two groups of foreign language learners in grades 5, 7 and 9, and linear mixed model analysis was used to explain the hierarchical structure of the data. The conclusions illustrate that students who started early performed better in years 5 and 9 than those who started later, suggesting that starting early may have long-term benefits and a broader range of effects on cognition. The effect of learner characteristics on cognitive levels remained stable with respect to gender, L1, achievement, cognitive ability and cultural capital (Darmody & Bendis, 2021).

In the study by Santiago Budría et al. (Budría & Martínez-de-Ibarreta, 2021) it was asked to what extent language proficiency ensures that immigrants are protected from the risk of ending up working for a mismatched firm. Language proficiency was measured using the Bleakley and Chin strategy, and in order to distinguish between localized average treatment effects and average treatment effects, two alternative models were considered, the 2SLS instrumental variable and the double probability. Immigrants' language proficiency reduces the likelihood of ending up in overqualified jobs by 17.2 to 36.7 percentage points. Eisenberg, J et al. (Eisenberg, Glikson, & Lisak, 2021) suggest that globally distributed transnational virtual MNVT teams are becoming more common, and in order to better understand communication in transnational virtuals, the effects of using simultaneous verbal and written communication media at different levels of English language instruction were explored.

Previous research on the achievements of language teaching communication has focused more on combing the teaching level and language proficiency with time clues, and the research on the cultural image in the international market influenced by the communication of language teaching to foreigners has not been in-depth. The influence of language teaching communication on the cognition of each dimension is very important. This paper looks at the influence of foreign language teaching communication on the cognition of Chinese enterprises' image, which can provide reference and reference for the communication and cooperation of Chinese enterprises in the international arena, and further enhance the international competitiveness of Chinese enterprises (Eagderi, Nikmehr, & Poorbagher, 2020).

Due to the massive and complex environment of the learning behavior data of Chinese as a foreign language, a behavioral label feature library of Chinese as a foreign language learning was established with five factors of overseas Chinese learners, including social dimension, emotional dimension, environmental dimension, physiological dimension and psychological dimension, and a fuzzy comprehensive evaluation index system was set up by virtue of the behavioral label feature library, and numerical processing was carried out to get the learning behavioral portraits of Chinese as a foreign language learners of different types and to determine the The learning behavior portraits of different types of Chinese as a foreign language learners were obtained by numerical processing to determine the mastery level of Chinese as a foreign language learning ability. And based on the clustering data of Chinese as a foreign language learning behaviors, a reliability analysis is carried out to determine the measurement indexes of consistency reliability. Combining the principles and methods of structural equation modeling, we constructed a model of the factors influencing individual cognitive differences in the communication of teaching Chinese as a foreign language, and established 12 observation variables with knowledge base, cognitive ability and psychological characteristics as latent variables, and put forward four hypotheses about the influence of the communication of teaching Chinese as a foreign language on the cognition of China's corporate image through the analysis and research of latent variables and observation variables.

Behavioral analysis equations for learning Chinese as a foreign language

China's interactions with the rest of the world are becoming more and more frequent and close, and the number of Chinese language learners is rising year by year. Due to the differences in educational backgrounds, professional differences and other aspects of overseas learners of Chinese, their learning

behaviors are also diverse. It is necessary to study the learning behaviors of different learners to make the results of the analysis of learning behaviors of learners of Chinese as a foreign language more intuitive. By applying the learning behavior analysis model of Chinese as a foreign language, foreign countries are able to better understand the customs and business communication styles of Chinese enterprises, and more accurately study the impact of teaching Chinese as a foreign language on spreading the perception of Chinese corporate image (Motaganahalli, Menard, Koopman, & Farber, 2020).

Behavioral Labels for Learning Chinese as a Foreign Language

Through the reference literature and survey research, screening acquisition to get five dimensional indicators of Chinese language learning behavior for foreigners (Han & He, 2023). Figure 1 shows the evaluation index system of learning behavior of Chinese as a foreign language, which are social dimension, emotional dimension, environmental dimension, physiological dimension and psychological dimension of learners. The purpose of clustering Chinese language learning behavior labels is to quickly obtain the behavioral characteristics of different types of learners. Therefore, the selection of labels needs to consider the features that best reflect the learning behaviors of Chinese as a foreign language learner.

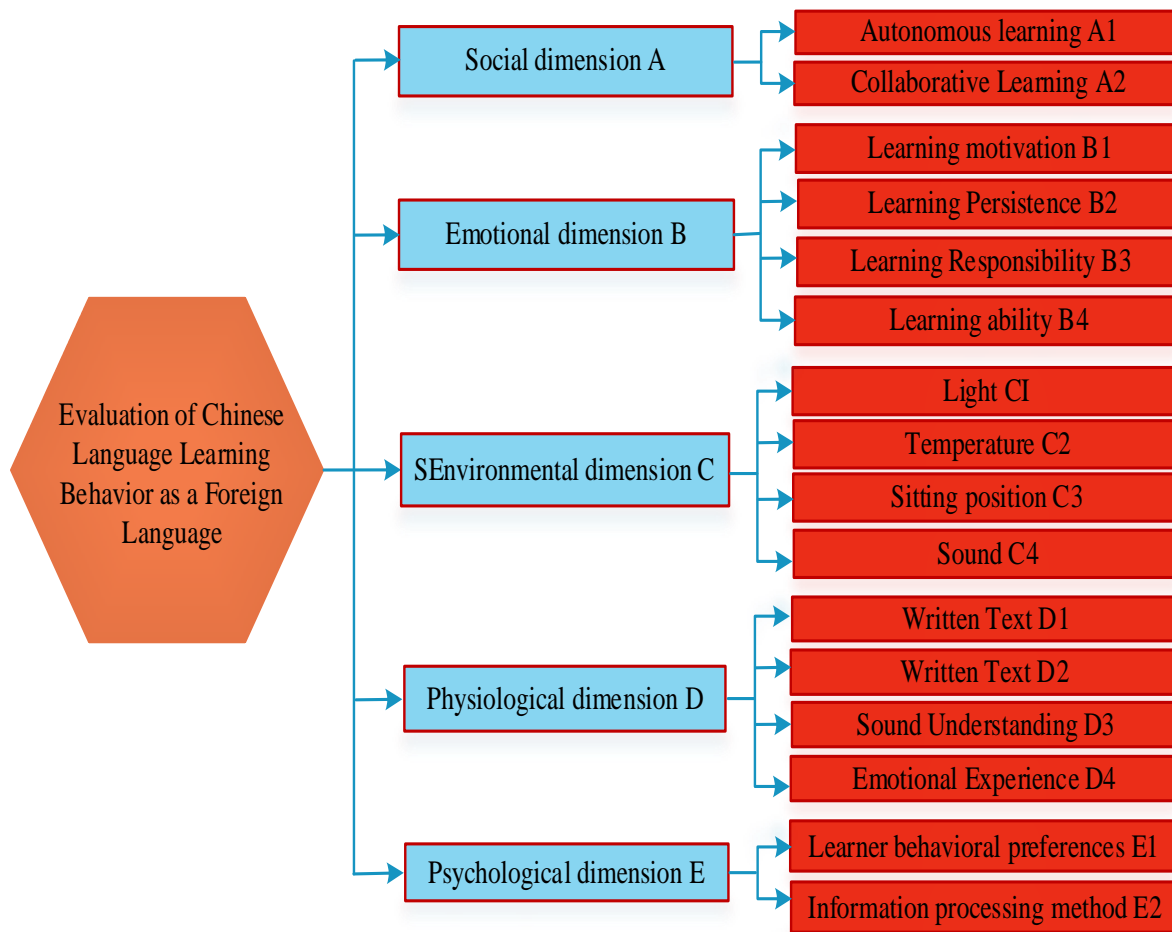


Figure 1: Evaluation indicators for learning Chinese as a foreign language behavior

Fuzzy integrated evaluation method

Since only numerical vectors can be used for cluster analysis, they are numericalized through the multilevel fuzzy comprehensive evaluation method. The fuzzy comprehensive evaluation index system U , and the factor set U of the evaluation index system of Chinese language learning behavior to foreigners (Chen, Wang, & Zhou, 2022; Ni, 2021) are established. It is as follows:

$$U = \{U_1, \dots, U_i, \dots, U_n\} \quad (1)$$

Where U represents the first level factor set, where $U = \{U_1, \dots, U_{i2}, \dots, U_{in}\}$, $(i = 1, 2, \dots, n)$ represents the second level factor set, and the evaluation index system is the aggregate relationship of the factor set:

$$U_i \cap U_j = \phi(i = j) \quad (2)$$

Constructing a judgment matrix using hierarchical analysis and scaling method to determine the weight of each indicator. The judgment matrix is the importance of the relevant element of this level relative to an element of the previous level, and the consistency test formula is:

$$I_C = \frac{\lambda_{max}}{n-1} \quad (3)$$

$$I_{CR} = I_C / I_R \quad (4)$$

When $I_{CR} < 0.1$, the judgment matrix passes the consistency test. The eigenvectors corresponding to the largest eigenvalue λ_{max} are normalized to obtain the weight set \tilde{w} and weight set \tilde{w}_i of the primary factor set U and secondary factor set U_i :

$$\tilde{w} = \{\tilde{w}_1, \tilde{w}_2, \dots, \tilde{w}_n\}, \sum_{i=1}^n \tilde{w}_i = 1 \quad (5)$$

$$\tilde{w}_i = \{\tilde{w}_{i1}, \tilde{w}_{i2}, \dots, \tilde{w}_{im}\}, \sum_{j=1}^m \tilde{w}_{ij} = 1 \quad (6)$$

Assuming that the evaluation level set is $V = \{V_1, V_2, \dots, V_p\}$, the state quantities of each indicator of Chinese language learning behavior to foreigners are divided into 4 levels, which are excellent, good, moderate and poor. That is, $p = 4$, where $V_1 = 80, V_2 = 60, V_3 = 40$, and $V_4 = 20$.

First, a single-factor fuzzy evaluation is performed on the secondary factor set $U_i (i = 1, 2, \dots, n)$ to determine the affiliation of each evaluation level V_k of the evaluation factor object $r_{jk} (j = 1, 2, \dots, m; k = 1, \dots, p)$. After that, the single-factor pattern evaluation matrix $\tilde{R}_i = (r_{jk})_{m \times p}$ of the secondary factor set U_i is obtained, and then the fuzzy comprehensive evaluation vector \tilde{C} is obtained with the following expression:

$$\tilde{C}_i = \tilde{w}_i \cdot \tilde{R}_i \quad (7)$$

The total fuzzy evaluation matrix \tilde{C} is obtained according to Equation (7), after which the second level fuzzy comprehensive evaluation vector \tilde{B} is calculated (Liu et al., 2022; Sun, 2022). The expression is as follows:

$$\tilde{C} = \{\tilde{C}_1, \tilde{C}_2, \dots, \tilde{C}_n\}^T \quad (8)$$

$$\tilde{B} = \tilde{w} \cdot \tilde{C} = \{b_1, b_2, \dots, b_p\} \quad (9)$$

Chinese as a Foreign Language Learning Behavior Clustering

Assume that the data on learning behavior of Chinese as a foreign language is $N \times D$ -dimensional:

$$X = \begin{bmatrix} x_{11}, \dots, x_{1j}, \dots, x_{1D} \\ \dots, \dots, \dots, \dots \\ x_{i1}, \dots, x_{ij}, \dots, x_{iD} \\ \dots, \dots, \dots, \dots \\ x_{N1}, \dots, x_{Nj}, \dots, x_{ND} \end{bmatrix} \quad (10)$$

Assuming that the probability that each sample j belongs to the i nd clustered subset is U_{ij} , to cluster the sample data into K subsets $C = \{c_1, \dots, c_i, \dots, c_k\}$, the FCM can be transformed into an optimization problem:

$$\min J = \sum_{i=1}^K \sum_{j=1}^N u_{ij}^m \|x_j - c_i\|^2 \quad (11)$$

$$\text{s. t. } \sum_{i=1}^K u_{ij} = 1 \quad (12)$$

where J is the value function of the FCM, m is the weighting coefficient, and generally $m = 2$. To facilitate the solution of this optimization problem, Lagrange multipliers are introduced into the objective function:

$$J' = \sum_{i=1}^K \sum_{j=1}^N u_{ij}^m \|x_j - c_i\|^2 + \sum_{i=1}^K \lambda_i (\sum_{j=1}^N u_{ij} - 1) \quad (13)$$

Cluster center c_k and affiliation u_{kj}^m are derived:

$$\begin{cases} \frac{\partial J'}{\partial u_{ij}} = m \|x_j - c_i\|^2 u_{ij}^{m-1} + \lambda_j = 0 \\ \frac{\partial J'}{\partial c_i} = \sum_{j=1}^K (-2u_{ij}^m (x_j - c_i)) = 0 \end{cases} \quad (14)$$

The iterative formulas for clustering centers and affiliation coefficients are obtained through equation (12):

$$c_i = \frac{\sum_{j=1}^N (x_j u_{ij}^m)}{\sum_{j=1}^N u_{ij}^m}, u_{ij} = 1 / \sum_{k=1}^K \left(\frac{\|x_j - c_i\|}{\|x_j - c_k\|} \right)^m \quad (15)$$

It is iterated repeatedly through the iterative formula of clustering center and affiliation coefficient until the convergence condition of FCM is reached. The clustering process of learning behavior of Chinese as a foreign language based on fuzzy C mean is shown in Fig. 2. Randomly initialize the affiliation moment U , set the number of clusters K and the affiliation factor m . Calculate the clustering centers of the labels of Chinese language learning behaviors for foreigners according to Eq. (15) and the affiliation matrix of the clustering centers U , and assign the Chinese language learning behaviors for foreigners to the clustering centers with the highest affiliation degree. If the value of the objective function is smaller than the preset threshold, output the clustering result. Instead, go back to step 2 and finally save and display the clustering results (Tang, Xie, Zhang, Zhang, & Zhang, 2021).

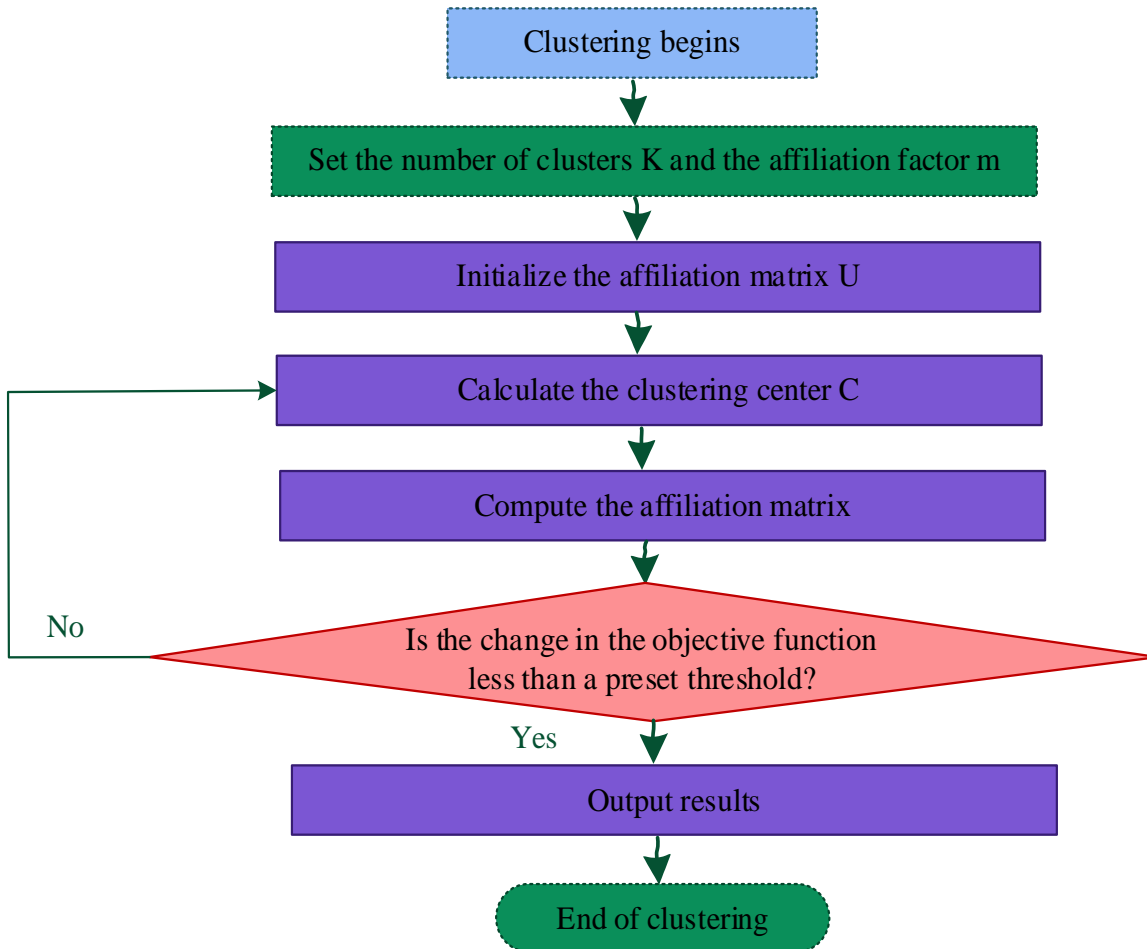


Figure 2: Clustering process of learning Chinese as a foreign language behavior

Predictive Modeling of the Impact on Perceptions of Chinese Corporate Image

Reliability analysis

Since the situation of teaching Chinese as a foreign language communication and the perception of Chinese corporate image cannot be evaluated by a single indicator, and the variables of teaching Chinese as a foreign

language communication and the perception of Chinese corporate image are characterized by high dimensionality and complexity, which cannot be measured accurately and directly by the traditional statistical analysis methods, such variables are called latent variables, and structural equation modeling can deal with this kind of variables and their indicators very well. Structural equation modeling is an inclusive mathematical model that can be used to analyze some complex relationships involving latent variables (Mueller & Noack, 2023).

In this paper, the Cronbach coefficient is selected as a measure of the consistency reliability of the same variable measurement item, and the data on the learning behavior of Chinese as a foreign language after clustering in the above paper are analyzed, and the results of the analysis of 10 samples are shown in Table 1. In terms of reliability measurement of each scale, the Cronbach coefficients of each factor of Chinese as a foreign language knowledge base, Chinese as a foreign language cognitive ability, and Chinese as a foreign language psychological characteristics are all higher than 0.7, and the reliability coefficients of 0.65-0.70 are the minimum acceptable values, 0.70-0.80 are quite good, and 0.80-0.90 are very good.

Table 1 Cronbach's reliability coefficient of latent variables

Latent Variable	Value
Fundamentals of Chinese as a Foreign Language	0.71
Cognitive ability in Chinese as a foreign language	0.83
Psychological Characteristics of Chinese as a Foreign Language	0.77

Modeling impact prediction

Impact of pedagogical communication

The pioneering role of a priori theories of specialized knowledge is particularly important in structural equation analysis, where sound measurement and structural models can be constructed on the basis of professionally conceived experiences or in conjunction with exploratory factor analysis. It is used to fit data with a view to proving professionally pre-existing theoretical hypotheses.

Taking individual cognitive differences in the integration of pedagogical knowledge as the core of the study, the influence of knowledge base, cognitive ability, and psychological characteristics on individual cognitive differences in the process of team product development was modeled using a structural equation approach (Barragán-Sánchez, Corujo-Vélez, Palacios-Rodríguez, & Román-Graván, 2020; Wu, Zheng, & Zhai, 2021). Taking knowledge base, cognitive ability, and psychological characteristics as latent variables, and professional knowledge y_1 , basic knowledge y_2 , experience shortcuts y_3 , innovation ability y_4 , attention ability y_5 , memory ability y_6 , learning ability y_7 , communication ability y_8 , self-trust y_9 , self-expectation y_{10} , willingness to communicate y_{11} , and teamwork y_{12} as observational variables, the initial model was derived through the analytical study of latent and observational variables from a multi-perspective dimensions, Figure 3 shows the influence of the influence factors of the communication of teaching Chinese as a foreign language on the perception of Chinese corporate image as follows:

- (1) From the perspective of Chinese language knowledge base, utilizing the knowledge dissemination of teaching Chinese as a foreign language, Chinese enterprises are able to break the language barrier in the international market. Enhance brand cognition, promote cultural exchange and cooperation, and further enhance their competitiveness and influence.
- (2) From the perspective of Chinese cultural cognitive ability, study the cognitive differences of corporate image in different cultural contexts in order to reveal the degree and mode of influence of individual cognitive differences on corporate image in different cultures.
- (3) From the perspective of Chinese language psychology, to explore what kind of psychological mechanism overseas people's perception of corporate image is based on. As a multidisciplinary cross-disciplinary field involving linguistics, psychology and cross-cultural communication, psychology of Chinese as a foreign language can help enterprises more accurately grasp consumers' needs and psychological demands, so as to formulate a strategy adapted to the target market and build up a good image.

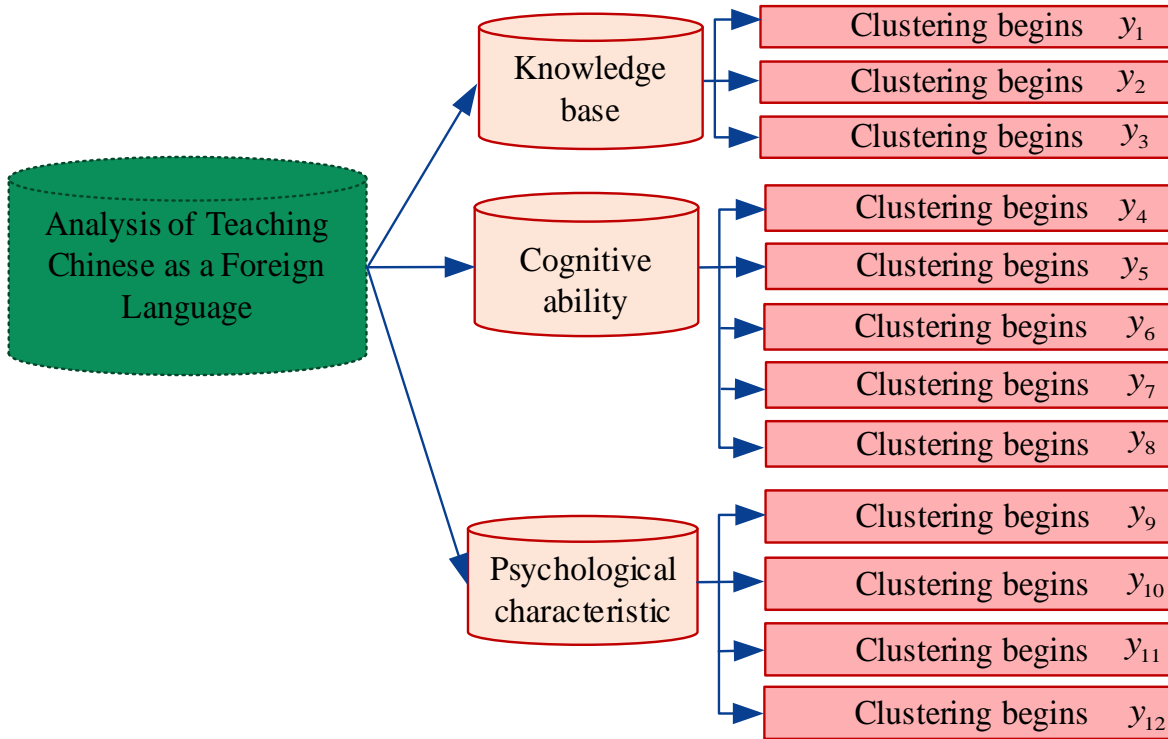


Figure 3: Impact Factor Model of Teaching Chinese as a Foreign Language Communication

Structural models

Causal relationships between variables and potential endogenous variables, ie:

$$\eta = A\eta + \Gamma\xi + \zeta \quad (16)$$

Measurement models

Measurement models generally consist of two parts that specify the relationship between potentially endogenous and endogenous measurable variables, and between potentially exogenous and exogenous explicit variables, i.e., respectively:

$$y = \Lambda_y\eta + \varepsilon \quad (17)$$

$$z = \Lambda_z\xi + \delta \quad (18)$$

where $y(p \times 1)\eta$ is the measurable variable for potential endogenous variable η , $x(q \times 1)$ is the measurable variable for potential exogenous variable ξ , $\Lambda_y(p \times m)$ is the matrix of regression coefficients for y vs. η , $\varepsilon(p \times 1)$ is the matrix of regression coefficients for X vs. ξ , and $\varepsilon(p \times 1)$, $\delta(q \times 1)$ are the corresponding vectors of measurement errors, respectively.

Developing an impact hypothesis

The correlation coefficient matrix of the 12 observed variable indicators is established as shown in Table 2, and the structural equation model of the factors affecting the individual cognitive differences in the communication of teaching Chinese as a foreign language is established to analyze the structure of the cognitive differences in the corporate image in China that are affected. In the establishment process, parameter estimation is carried out by the great likelihood method, and finally the standardized regression coefficients are obtained. Also known as the path coefficient, it can be used to measure the degree of influence between variables or the effect size of variables. Since there are only three influence factors, and there are a total of three correlations when the model has only three first-order factors, the second-order factor model is expressed in terms of three path parameters, and is mathematically equivalent to the first-order factor model, since they are equivalent and the fit is identical, there is no need to analyze the model as a second-order factor model. Using data collection and processing of information and data with

behavioral analysis software and statistical software SPSS, the following hypotheses are proposed in conjunction with the above research:

- (1) H1 is that the knowledge base of Chinese as a foreign language has a positive effect on the perception of corporate image.
- (2) H2 is that cognitive ability in Chinese as a foreign language has a positive effect on corporate image perception.
- (3) H3 is that psychological characteristics of Chinese as a foreign language have a positive effect on corporate image perception.
- (4) H4 is the positive effect of Chinese as a foreign language teaching communication on the perception of Chinese corporate image.

Table 2 Correlation coefficient matrix between various indicators

Index coefficient	y ₁	y ₂	y ₃	y ₄	y ₅	y ₆	y ₇	y ₈	y ₉	y ₁₀	y ₁₁	y ₁₂
y ₁	1	-	-	-	-	-	-	-	-	-	-	-
y ₂	0.3956	1	-	-	-	-	-	-	-	-	-	-
y ₃	0.2763	0.3409	1	-	-	-	-	-	-	-	-	-
y ₄	0.2305	0.2326	0.2604	1	-	-	-	-	-	-	-	-
y ₅	0.2511	0.2291	0.2055	0.3013	1	-	-	-	-	-	-	-
y ₆	0.1401	0.2973	0.2556	0.3401	0.5106	1	-	-	-	-	-	-
y ₇	0.1611	0.2976	0.2544	0.3301	0.5109	0.4671	1	-	-	-	-	-
y ₈	0.1611	0.2637	0.1941	0.2031	0.3372	0.1719	0.2912	1	-	-	-	-
y ₉	0.1612	0.2063	0.2131	0.2537	0.3053	0.1502	0.2546	0.1402	1	-	-	-
y ₁₀	0.0901	0.1003	0.1511	0.2802	0.2932	0.1477	0.1663	0.1983	0.3349	1	-	-
y ₁₁	0.0961	0.0911	0.1933	0.2971	0.0946	0.1055	0.1077	0.1952	0.2641	0.3633	1	-
y ₁₂	0.0988	0.0861	0.1577	0.1021	0.1213	0.1286	0.1338	0.3132	0.2331	0.3106	0.2212	1

Analysis of simulation results of impact prediction models

In order to verify whether the model proposed in this paper can accurately validate the influence of the communication of teaching Chinese as a foreign language on the perception of Chinese corporate image, an empirical analysis is conducted. Combined with the structural equation software LIS-REL8.80 students, 100 college and university students studying Chinese abroad were selected for experimental analysis.

Predictive Model Impact Tests

According to the matrix of correlation coefficients shown in Table 2, the results of the factors influencing cognitive differences in the communication of teaching Chinese as a foreign language were derived as shown in Figure 4, in which KSI1, KSI2, and KSI3 represent the three factors of knowledge base, cognitive ability, and psychological characteristics, respectively VAR1, VAR2, VAR3, andVAR12 respectively represent the above 12 observed variables. The LISREL model in Figure 4 shows that the correlation coefficient between cognitive ability and knowledge base is 0.66, the correlation coefficient between cognitive ability and psychological characteristics is 0.51, and the correlation coefficient between psychological characteristics and knowledge base is 0.34.

Among the factors affecting individual cognitive differences, the correlation between knowledge base, cognitive ability, and psychological characteristics are all positive, of which, cognitive ability has the strongest effect on individual cognitive differences, and Psychological characteristics have the strongest influence on individual cognitive differences, and psychological characteristics have the smallest influence on individual cognition. Thus, it can be seen that hypothesis H1, hypothesis H2, and hypothesis H3 are significantly established, which is consistent with the analysis of the experimental results, indicating that in the process of teaching and spreading of Chinese as a foreign language, the influence of individual cognitive differences exists, and that cognitive ability, knowledge base, and psychological characteristics have a more significant influence on the cognition of corporate image among the many corporate image cognitive differences influencing factors.

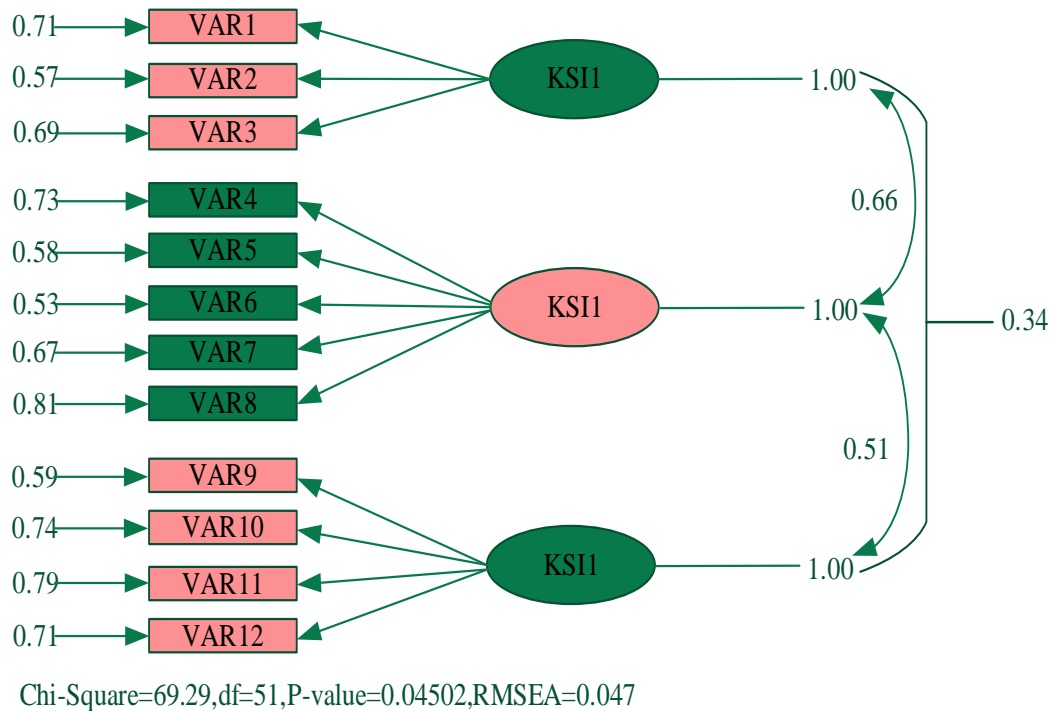


Figure 4: Results of Factors Influencing Cognitive Differences

Reliability and validity tests

The measurement reliability was tested by calculating the internal consistency coefficient, and the results of the reliability and validity tests of the variable measures are shown in Table 3. The results of the reliability test show that the Cronbach values for corporate image range from 0.814 to 0.867, all of which exceed the critical value of 0.7 proposed by Nun-nally, indicating that the variable measurements in this study have good reliability. The results of the validity test showed that. Validity includes content validity and structural validity, which in turn includes convergent validity and discriminant validity. In terms of convergent validity, the variables were subjected to validated factor analysis CFA, and the standardized loading coefficients of the variables were all greater than 0.5 and highly significant, while the CR of the combination of latent variables was greater than 0.8 and the AVE of the average extracted variance was greater than 0.5, which satisfied the three criteria of convergent validity, indicating that the convergent validity of the variable measurements was good. Overall, the model in this paper has good reliability and validity.

Table 3 Reliability and validity test results of variable measurement (N=265)

Variable	Latent variable	Observation variables	Factor load	Residual	T value	CR	AVE
Corporate image recognition	Fundamentals of Foreign Teaching Knowledge	Professional knowledge	0.790	0.256	10.497	0.883	0.633
		Basic knowledge	0.717	0.381	11.957		
		Experience shortcuts	0.894	0.200	10.613		

Cognitive ability in external teaching	Innovation ability	0.799	0.330	10.285	0.861	0.651
	Attention ability	0.767	0.361	11.533		
	Memory ability	0.759	0.351	11.268		
	Learning ability	0.752	0.236	10.632		
	Communication skills	0.713	0.321	11.215		
Psychology of Chinese as a Foreign Language	Self-trust	0.771	0.331	11.484	0.858	0.619
	Willingness to communicate	0.723	0.278	11.088		
	Team work	0.842	0.208	12.283		
	Self-expectation	0.710	0.455	11.624		

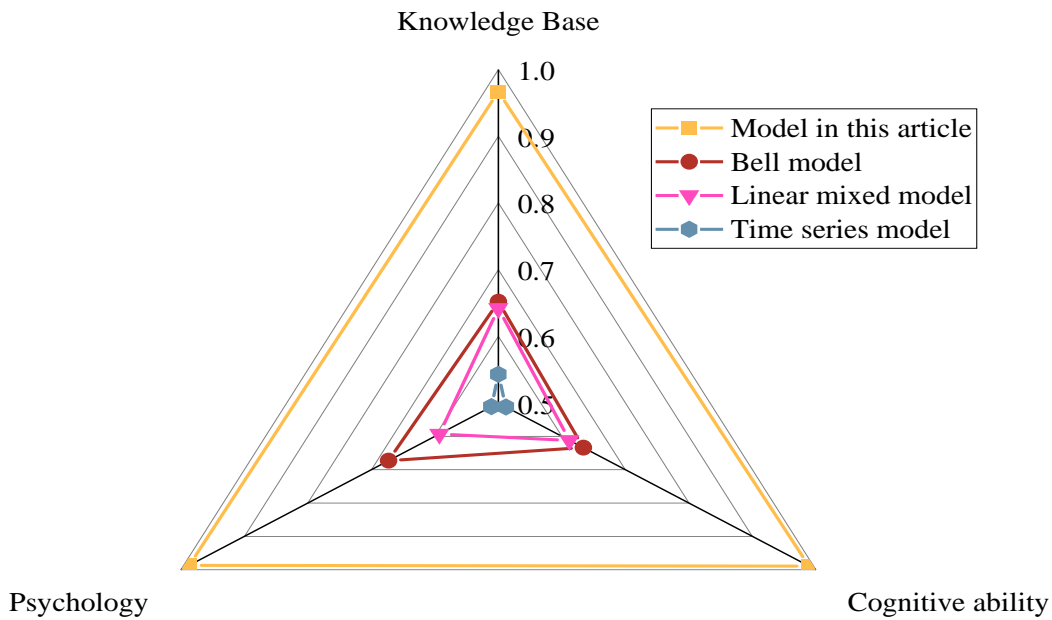
Impact on model accuracy

After parameter estimation of model confidence and validity, the non-functional fit index NNFI and comparative fit index CF1 as well as the mean absolute error were used as experimental metrics, and comparative analyses of model fit goodness-of-fit and mean absolute error were conducted with the Bell model, the linear mixed model, and the time series model.

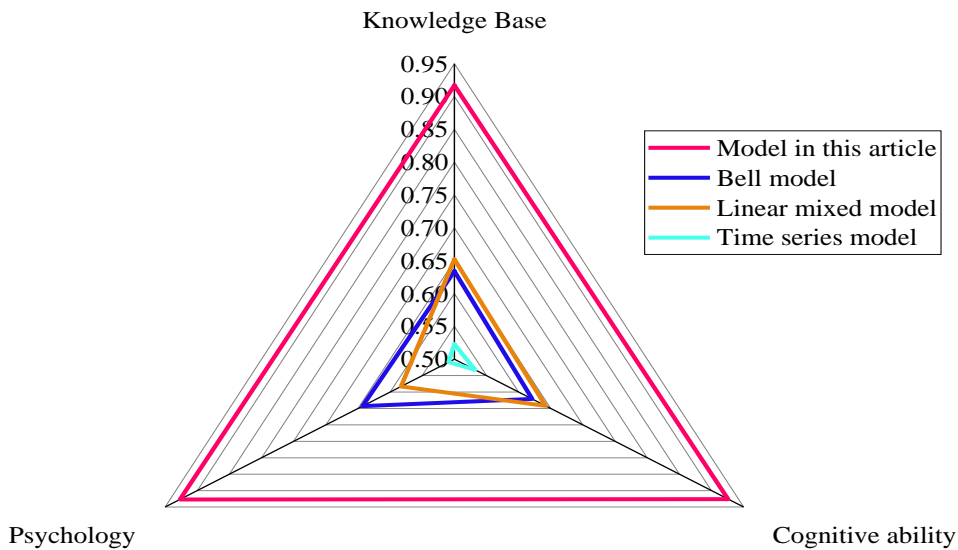
Goodness-of-fit report

Figure 5 shows the goodness of fit of the model. The results of the comparison of the non-fugitive fitting index NNFI are shown in Figure 5(a), based on the model's goodness of fit, the non-fugitive fitting index NNFI of Bell's model for the knowledge base of Chinese as a foreign language is 0.652, that of cognitive ability in Chinese as a foreign language is 0.634, and that of psychological traits in Chinese as a foreign language is 0.673. The linear mixed model's NNFI of the linear mixed model is 0.642 for the knowledge base of Chinese as a foreign language, 0.612 for the cognitive ability, and 0.593 for the psychological characteristics, while that of the time series model is 0.543 for the knowledge base of Chinese as a foreign language, 0.543 for the cognitive ability, and 0.573 for the cognitive ability, respectively. The NNFI of the time series model is 0.543 for the knowledge base of Chinese as a foreign language, 0.512 for the cognitive ability, and 0.511 for the psychological traits. On the contrary, in the model of the present paper, the non-fugitive fit index of the knowledge base of Chinese as a foreign language is 0.967, that of the cognitive ability is 0.989, and that of the psychological traits is 0.987, which means that the NNFI of the model is non-fugitive.

The comparison results of the fit index CF1 are shown in Fig. 5(b), and the comparative fit indices CF1 of the Bell model for the knowledge base of Chinese as a foreign language, cognitive ability, and psychological characteristics are 0.634, 0.621, and 0.643, respectively. The comparative fit indices CF1 of the linear mixed model for the knowledge base of Chinese as a foreign language, cognitive ability, and psychological characteristics are 0.652, 0.642, and 0.583, respectively. The comparative fit indices CF1 of the time series model for Chinese as a foreign language knowledge base, cognitive ability, and psychological traits are 0.523, 0.532, and 0.509 respectively, and the comparative fit indices CF1 of the model in this paper for Chinese as a foreign language knowledge base are 0.917, the non-fugitive fit index NNFI of the cognitive ability is 0.926, the non-fugitive fit index NNFI of the psychological characteristics is 0.926, the NNFI is 0.917, the NNFI is 0.926, the NNFI is 0.927, and the comparative fit index CF1 has a goodness-of-fit greater than 0.9, which further verifies that the hypotheses H1, H2, and H3 are valid, and that the knowledge base of Chinese as a foreign language, cognitive ability, and psychological characteristics have a positive effect on the perception of corporate image.



(a) Non normed fitting index



(b) Comparison fit index

Figure 5: Goodness of fit report of the model

Reporting of mean absolute errors

The results of the random error test of each model are shown in Figure 6, the average absolute error index of the Bell model gradually increased from 1.67 to 3.01 at the very beginning time, and remained stable in the range of 2.72 at the 9th iteration. The average absolute error of the linear mixed model gradually increased from 1.25 to 2.71 at the beginning of the time, and was gradually on a decreasing trend in the second iteration, and was always in the range of 2.71-2.74 in the first 6 iterations, and decreased to 2.46 in the 9th iteration. The average absolute error of the time series model gradually increased from 0.59 to 2.69 at the beginning of the time, and remained stable in the range of 2.72 in the first 5 iterations. , which is always within the range of 2.69-2.55 during the first 5 iterations, and the stochastic error index decreases to 1.76 at the 9th iteration. The average absolute error of this paper's model gradually rises from 0.21 at the very beginning time to 2.23, and during the first 6 iterations, it is always in the range of 2.71-2.74, and at the 9th iteration, the random error index decreases to 0.19. It shows that this paper's model has the smallest error value in the analysis of the conditions of influence on the spread of teaching Chinese as a foreign language.

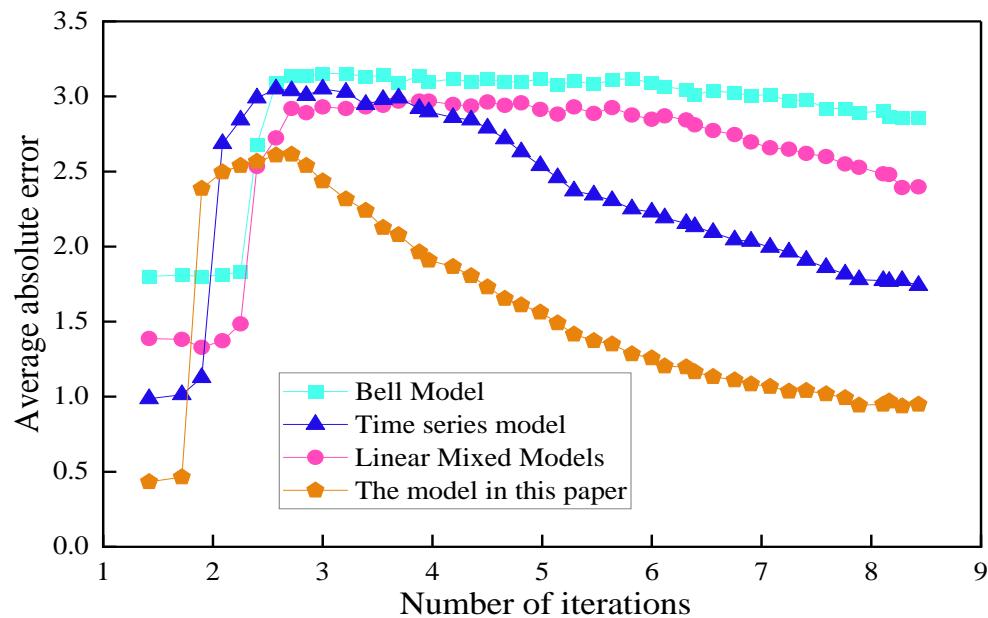


Figure 6: Random Error Test Results

Three-dimensional test of corporate image

This experimental subsection examines the distributional effects of Chinese language teaching diffusion rate on corporate image in order to better examine the effects of Chinese language teaching diffusion rate to foreigners on corporate image in different corporate firms. In this way, we can determine the effect of the spread of teaching Chinese as a foreign language on the perception of Chinese corporate image. The three-dimensional evaluation criterion of corporate image refers to the three criteria used by corporate culturology to evaluate the advantages and disadvantages of corporate image, which refer to the degree of civilization, visibility and reputation. The degree of civilization refers to the inner quality of a company, such as whether the guiding ideology of conducting production and operation and participating in market competition is correct. Visibility refers to how many people know about a company's existence. Reputation refers to the extent to which a company is praised by the public. p10%, p20%, p50%, p80%, and p100% represent the Chinese teaching dissemination rate of 10%, the Chinese teaching dissemination rate of 20%, the Chinese teaching dissemination rate of 50%, the Chinese teaching dissemination rate of 80%, and the Chinese teaching dissemination rate of 100%, respectively.

The influence of Chinese teaching dissemination rate on the three-dimensional image of enterprises is shown in Figure 7. The degree of civilization of enterprise image shows a local upward curve with the increase of Chinese teaching dissemination rate. At the p10% loci, the degree of civilization of corporate image is 37.21%, the awareness of corporate image is 36.41%, and the reputation of corporate image is 30.65%. With the rise of the Chinese teaching dissemination rate loci, all the three-dimensional evaluations of corporate image also rise gradually. At the p50% loci, corporate image civilization is 53.51%, corporate image visibility is 49.81%, and corporate image reputation is 49.67%. At the p80% locus, the degree of civilization of corporate image is 74.51%, the visibility of corporate image is 72.82%, and the reputation of corporate image is 76.95%. It shows that the three-dimensional evaluation indexes of corporate image are increasing with the spreading range of Chinese language, and when the spreading rate of Chinese language teaching is at p100%, the degree of corporate image civilization is already as high as 86.34%, the degree of corporate image popularity is 88.45%, and the degree of corporate image goodwill is as high as 90.24%. Verify that hypothesis H4 is valid, the positive effect of foreign Chinese teaching dissemination on the perception of Chinese corporate image is most significant.

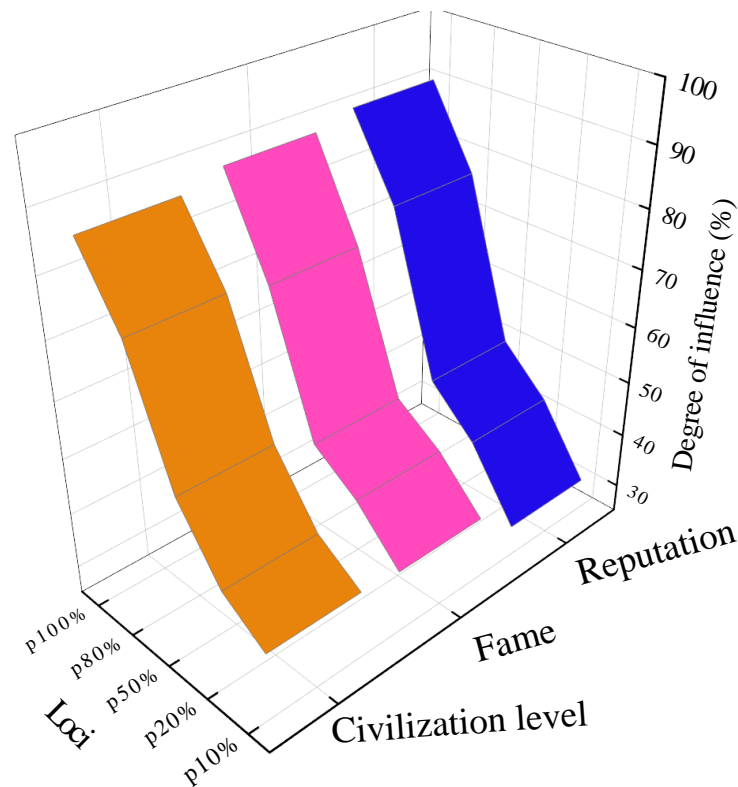


Figure 7: Analysis of the impact on the three-dimensional image of enterprises

Discussion

In the context of globalization, Chinese enterprises play an increasingly important role in the international market. As a bridge to promote cross-cultural communication, teaching Chinese as a foreign language has a profound impact on the perception of Chinese enterprises' international image. Future research can focus on the following aspects:

- (1) Further in-depth research on the communication strategies of teaching Chinese as a foreign language on different media platforms, exploring how to accurately convey the core values and brand image of Chinese enterprises through the Internet, social media, traditional media, and other channels, so as to enhance the outside world's perception of the enterprises.
- (2) Emphasize the image perception of Chinese enterprises in different cultural contexts, and explore how to help enterprises better understand the culture of the international market, eliminate cultural barriers, and achieve effective communication in cross-cultural exchanges through teaching Chinese as a foreign language.
- (3) To study how to combine the internationalization strategy of Chinese enterprises with the content of teaching Chinese as a foreign language to cultivate talents with an international outlook. Thus, students will learn to understand enterprises in depth and contribute positively to their global communication.

Conclusion

Based on structural equation modeling, this paper analyzes the influence of teaching communication in Chinese as a foreign language on the perception of Chinese corporate image from a multidimensional and three-dimensional perspective, and verifies the validity of the proposed hypotheses:

- (1) The correlation coefficient between cognitive ability and knowledge base is 0.66, and the correlation coefficient with psychological characteristics is 0.51, and the correlation coefficient with knowledge base is 0.34. The correlations are all positive. The validity of hypothesis H1, hypothesis H2, and hypothesis H3 is verified, which strengthens the influence of these correlations on the perception of corporate image.

(2) In the analysis of measuring convergent validity, the standardized loading coefficients of each variable are greater than 0.5, the CR of each latent variable combination is greater than 0.8, and the average extracted variance AVE is greater than 0.5, indicating that the model's reliability and validity are excellent.

(3) The non-assignment fit indices CF1 for the knowledge base of Chinese as a foreign language, cognitive ability and psychological characteristics show the good fit of these variables in the model. The comparative fit indices and the random error indices showed a positive effect and both were well above the threshold of 0.9, showing the robustness of the model in explaining the correlations.

(4) When the transmission rate of Chinese language teaching is at the p100% locus, the degree of corporate image civilization is 86.34%, the degree of corporate image awareness is 88.45%, and the degree of corporate image reputation is 90.24%. It shows that hypothesis H4 is valid, indicating the important role of foreign Chinese teaching communication in shaping the perception of Chinese corporate image and providing reliable support for the overall improvement of corporate image.

Reference

- Alakkas, A. A., Vivek, Paul, M., Nabi, M. K., & Khan, M. A. (2022). Corporate social responsibility and firm-based brand equity: the moderating effect of marketing communication and brand identity. *Sustainability*, 14(10), 6033.
- Barragán-Sánchez, R., Corujo-Vélez, M.-C., Palacios-Rodríguez, A., & Román-Graván, P. (2020). Teaching digital competence and eco-responsible use of technologies: Development and validation of a scale. *Sustainability*, 12(18), 7721.
- Budría, S., & Martínez-de-Ibarreta, C. (2021). Education and skill mismatches among immigrants: The impact of host language proficiency. *Economics of Education Review*, 84, 102145.
- Chen, L., Wang, L., & Zhou, Y. (2022). Research on data mining combination model analysis and performance prediction based on students' behavior characteristics. *Mathematical Problems in Engineering*, 2022, 1-10.
- Cuadrado, J. T., Lim, D. S., Alcontin, R. M. S., Calang, J. L. L., & Jumawan, J. C. (2019). Species composition and length-weight relationship of twelve fish species in the two lakes of Esperanza, Agusan del Sur, Philippines. *FishTaxa*, 4(1), 1-8.
- Darmody, B., & Bendis, R. (2021). Creating Communities of Life Science Innovation in the US: History of Critical Factors That Helped the BioHealth Capital Region Emerge. *Journal of Commercial Biotechnology*, 26(1). doi:<https://doi.org/10.5912/jcb966>
- Eagderi, S., Nikmehr, N., & Poorbagher, H. (2020). Ponticola patimari sp. nov. *FishTaxa*.
- Eisenberg, J., Glikson, E., & Lisak, A. (2021). Multicultural virtual team performance: The impact of media choice and language diversity. *Small Group Research*, 52(5), 507-534.
- Fang, N. (2021). Psychological influence of Chinese film and television works in teaching Chinese as a foreign language. *The International Journal of Electrical Engineering & Education*, 00207209211002069.
- Freyhof, J., & YoGurtÇuoGlu, B. (2020). A proposal for a new generic structure of the killifish family Aphaniidae, with the description of Aphaniops teimorii (Teleostei: Cyprinodontiformes). *Zootaxa*, 4810(3), zootaxa. 4810.4813. 4812-zootaxa. 4810.4813. 4812.
- Gong, Y. F., Gao, X. A., & Lyu, B. (2020). Teaching Chinese as a second or foreign language to non-Chinese learners in mainland China (2014–2018). *Language Teaching*, 53(1), 44-62.
- Han, D., & He, Y. (2023). The reinforcement learning model with heterogeneous learning rate in activity-driven networks. *International Journal of Modern Physics C*, 34(07), 2350092.
- Hong, S.-Q., & Yue-Jun, H. (2021). Relationship among reverse logistics, corporate image and social impact in medical device industry. *Revista de Cercetare și Intervenție Socială*, 72, 109-121.
- Hung, K.-Y., Lin, M.-H., & Wu, S.-M. (2021). Effects of social responsibility and corporate image on online word of mouth in cultural and creative MICE industry. *Revista de Cercetare și Intervenție Socială*, 72, 175-186.
- Jaekel, N., Schurig, M., van Ackern, I., & Ritter, M. (2022). The impact of early foreign language learning on language proficiency development from middle to high school. *System*, 106, 102763.
- Jin, J., Mercer, S., Babic, S., & Mairitsch, A. (2021). 'You just appreciate every little kindness': Chinese language teachers' wellbeing in the UK. *System*, 96, 102400.
- Li, L., Valcke, M., Dessein, B., Badan, L., & Anderl, C. (2021). Pedagogical content knowledge: A systematic

- review of Chinese language pronunciation teaching in the CFL context. *Foreign Language Annals*, 54(2), 525-557.
- Liu, S., Liu, Y., Zhang, X., Guo, W., Kang, L., Yu, R., & Sun, Y. (2022). Geological and engineering integrated shale gas sweet spots evaluation based on fuzzy comprehensive evaluation method: a case study of Z shale gas field Hb block. *Energies*, 15(2), 602.
- Lyu, B., Lai, C., Lin, C.-H., & Gong, Y. (2021). Comparison studies of typing and handwriting in Chinese language learning: A synthetic review. *International Journal of Educational Research*, 106, 101740.
- Motaganahalli, R., Menard, M., Koopman, M., & Farber, A. (2020). Best endovascular versus best surgical therapy in patients with critical limb ischemia (BEST-CLI) trial. *Vasc. Endovasc. Rev*, 3, e05.
- Mueller, F., & Noack, E. M. (2023). Impact of Language Barriers on Emergency Rescue Dispatch: Quality Indicators and Emergency Characteristics. *NOTARZT*.
- Ni, J. (2021). Predictive analysis of user behavior of E-commerce platform based on machine learning image algorithm in internet of things environment. *Journal of Intelligent & Fuzzy Systems*(Preprint), 1-8.
- Sun, B. (2022). Comprehensive Evaluation and Analysis of Ecological Language Development in Consideration of Q-Learning Algorithm. *Mathematical Problems in Engineering*, 2022.
- Tang, Y., Xie, Y., Zhang, C., Zhang, Z., & Zhang, W. (2021). One-step multiview subspace segmentation via joint skinny tensor learning and latent clustering. *IEEE transactions on cybernetics*, 52(9), 9179-9193.
- Tong, P., & Tsung, L. (2020). Humour strategies in teaching Chinese as second language classrooms. *System*, 91, 102245.
- Wu, G., Zheng, J., & Zhai, J. (2021). Individualized learning evaluation model based on hybrid teaching. *International Journal of Electrical Engineering Education*.
- Xu, W., & Knijnik, J. (2021). Critical Chinese as an Additional Language education in Australia: A journey to voices, courage and hope. *British Educational Research Journal*, 47(6), 1635-1651.