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Evaluation of Chinese Learning Efficiency of International Students in China

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This paper investigates the related factors of Chinese learning engagement and performance of 377 students from three universities in Guangzhou of China, employs the value engineering method, and calculates the value coefficient of learning efficiency. From the value coefficient of Chinese language learning, it proves that over 60% of international students studying in China have a higher efficiency in learning Chinese.

Keywords: international students in China, evaluation of Chinese learning efficiency, value engineering, learning engagement, learning performance

Introduction

For international students studying in China, learning Chinese well and using it for their future work and life is their main goal. However, most international students studying in China take the form of pursuing a degree. For most international students who only pursue a bachelor's degree, it usually takes 2 to 4 years of study. How to achieve the expected performance in Chinese language learning within a limited time is not only the goal of international students studying in China, but also a concern for Chinese language learning efficiency for foreign language teachers and researchers. In the practice of teaching Chinese as a foreign language, it is normal for international students to experience uneven efficiency in learning Chinese. But for international students, what is their efficiency in learning Chinese? Is there room for improvement? And to what extent do Chinese language learning efficiency differ among different types of international students, such as different genders, countries or regions, family backgrounds, personalities, and learning objectives? These issues are worth exploring. Having a deep understanding of the efficiency and distribution characteristics of Chinese language learning among international students in China is beneficial for achieving personalized teaching in teaching Chinese as a foreign language and improving the efficiency of Chinese language learning for international students.

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The first and foremost task is to find a scientific method for evaluating the efficiency of Chinese language learning. In current research, more attention is paid to learning output or performance, neglecting the issue of learning efficiency. Regarding learning efficiency, the focus is on learning input and learning output.

Firstly, engage in learning. Learning engagement refers to the involvement of students in the learning process through interactions with peers and teachers (Lorena et al., 2013). Among them, NSSE was introduced to China by Tsinghua University in 2007 (NSSE China), and a survey was conducted nationwide in 2009. Another type is the Learning Engagement Scale (UWES-S) developed by Schaufeli et al. (2002), they believed it is the state in which an individual has abundant energy and good psychological resilience during learning, recognizes the significance of learning, is passionate about learning, and is immersed in their own learning. And categorize learning engagement into three dimensions: Vigor, Dedication, and Absorption. Each dimension contains 6, 5, and 6 items respectively, and its evaluation scope is limited to the students themselves.

Secondly, learning output. Learning engagement affects student performance (Mayer et al., 2009) and is a reliable predictor of student performance (Baker et al., 2004). The result of language learning engagement, after the learner's internal processing, processing, and absorption, is language learning performance. Libby and Luft (1993) constructed a learning performance function $P = K \times (M \times A \times E)$. Among them, P (Performance), K (Knowledge), M (Motivation), A (Ability), and E (Environment) represent learning performance, knowledge, learning motivation, learning ability, and learning environment, respectively. There are many factors that affect language learning performance, such as knowledge beliefs, metacognitive strategies, learning motivation and strategies, as well as the language ability, emotional factors, personality, and cognitive style of learners (Mohammad, 2012; Bozorgian, 2014; Zhang et al., 2016). Learning engagement is determined by the interaction between the environment and individuals, and the learning environment has a significant impact on student academic performance (Ahlfeldt et al., 2005).

Factually, school performance is the result, reflecting the quantity of learning, while learning efficiency is the process, which can better reflect the quality of learning. Learning performance does not necessarily reflect high learning efficiency. This paper focuses on the learning efficiency of international students rather than their learning performance, and attempts to introduce value engineering methods widely used in other disciplines into linguistics, and investigates the main learning input and learning performance factors of international students studying Chinese in China. The value coefficient of Chinese learning efficiency is calculated, and the Chinese learning efficiency of international students studying in China is analyzed from both the overall and sub dimensional levels.

Research Design

The VE Model of Chinese Learning Efficiency

According to the VE paradigm, construct a Chinese learning efficiency evaluation model, as shown in equation (1):

$$V = \frac{P}{C} = \frac{\sum_{k=1}^{n} \alpha_{ik} p_k}{\sum_{t=1}^{m} \omega_{jt} c_t} \tag{1}$$

In equation (1), i、j (both integers greater than 1) represent the number of total performance P, secondary indicators of total cost C, respectively. P is the comprehensive function of n types of learning performance generated by a certain international student after investing various learning resources; C is the comprehensive cost of C types of resources invested by the international student to achieve the established learning objectives. The calculation formulas are shown in (2) and (3) respectively:

$$P(p_1, p_2 \cdots p_k \cdots p_n) = \sum_{k=1}^{n} \alpha_{ik} p_k \tag{2}$$

$$C(c_1, c_2 \cdots c_t \cdots c_m) = \sum_{t=1}^{m} \omega_{jt} c_t \tag{3}$$

In equation (2), p_k represents the learning performance of the item k, which is a sub performance of P. α_{ik} represents the weight of the k-th third level performance indicator in the second level indicator of the class i. In equation (3), c_t represents the learning input of the item c_t, which is the sub cost of C. ω_{jt} represents the weight of the t-th third level investment indicator in the second level indicator of the j class. Among them, α_{ik} and ω_{jt} were determined by expert scoring method, we concluded that $\alpha_{ik} > 0$, $\omega_{jt} > 0$, $\sum \alpha_{ik} = \sum \omega_{jt} = 1$.

V is the value coefficient, which represents the learning efficiency of an individual international student. (1) $V > 1$, it indicates that the international student's investment and allocation of learning resources in various aspects have significantly produced good learning performance. (2) $V = 1$, it proves that the student's learning engagement matches their learning performance perfectly. (3) $V < 1$, the poor learning performance generated by the student's learning investment indicates that there is a lack of value or waste in the learning resources invested by the student. In other words, there is room for exploration.

Construction of an Evaluation Index System for Chinese Learning Efficiency

This paper invited 8 linguistic experts from four 211 Project universities in Guangzhou, China, to seek assistance in the following two aspects. One is the selection of indicators for international students' Chinese language learning engagement and learning performance. The second is based on the constructed learning

investment and performance indicator system, combined with a 1-9 scale assignment table for scoring. The hierarchy, interpretation, and measurement methods of relevant indicators are shown in Table 1

Table 1
Chinese Language Learning Engagement and Performance Indicator System

One-level indicators	Two-level indicators	Three-level indicators	Proxy variables	Measurement methods and explanations
Learning engagement	Physical investment	Cost investment	Extra expenses for learning Chinese this academic year (not a general school fee)[1]	Unit: Yuan
		Time investment	The average monthly time spent on extracurricular independent learning of Chinese this academic year (non academic tasks)	Unit: hour
	Emotional investment	Dynamism	The degree to which one feels energetic while learning Chinese	Likert Five Point Scale
		Dedication	The degree to which one feels energetic while learning Chinese	Likert Five Point Scale
		concentration	The degree of immersion in learning Chinese	Likert Five Point Scale
Learning performance	Test ability	Professional course grades	Average grade of professional courses this academic year	Multiply the scores of each major course by the credits, and then divide by the total credits of that course
		Chinese class grades[2]	Average score of Chinese language courses this academic year	Multiply the scores of each subject in the Chinese language category by the credits, and then divide by the total credits of that course
	Application capability	Social communication skills	Adaptation to social activities related to Chinese language	Likert Five Point Scale
		Language expression ability	Ability to engage in daily communication and written expression	Likert Five Point Scale
		Social practice ability	Competence level for participating in social practices related to Chinese language	Likert Five Point Scale

Empirical Process

Samples and Data

The research subjects are 2019 international students from Z University, H University, and J University in Guangzhou, Guangdong Province. International students who enrolled in September 2019 and graduated in June 2023 under a four-year full-time learning model were investigated. Due to data availability, this paper only investigated the Chinese language learning status of international students in the academic year 2021-2022 (i.e. their third year of college). The questionnaires were implemented in September 2022, and 415 questionnaires

[1] Spring semester covers summer vacation, and autumn semester covers winter vacation.
[2] This paper only discusses the use of Mandarin in the oral course and does not consider the Cantonese course.

were distributed. Due to the presence of a small number of international students dropping out, missing exams, and invalid samples in each semester of the academic year, a total of 377 valid samples were obtained, with an effective rate of 90.84%.

The survey method is to distribute, guide, and collect questionnaires in class by the teachers of the major. There are a total of 15 questionnaire items, of which 4 are basic personal information of students, 5 are about their investment in learning Chinese, 5 are about the effectiveness of learning Chinese, and 1 is about the purpose of learning Chinese.

Analytic Hierarchy Process (AHP)

Divide the evaluation indicators into target layer, criterion layer, and indicator layer. Classify the learning investment C and learning performance P of the one-level indicators as the target layer. Classify the physical and emotional investment of C, test ability and Application capability of P of the two-level indicators into the criterion layer. So, the three-level indicators $c_1 \sim c_5$ of C and the three-level indicators $p_1 \sim p_5$ of P belong to the target layer.

In order to test whether the selected target layer indicators are suitable for reflecting the criterion layer indicators, factor analysis was conducted on ten three-level indicators in SPSS software, and four factors were extracted, with a cumulative variance contribution rate of 78.89%. And the indicators included in each factor are consistent with Table 1, indicating that the selected indicators are suitable for AHP analysis.

On the basis of the constructed evaluation index system, this paper once again consulted the above-mentioned experts and assigned the importance of the corresponding three-level indicators to the four two-level indicators using the 1-9 scale method. The assignment principles of the 1-9 scale method are shown in Table 2.

Table 2
1-9 Scale Method Assignment Reference

Scale ω_{nm}	Importance	Scale ω_{nm}	Importance
1	The m element is equally important as the n element	2、4、6、8	The importance of element m and element n lies between two levels of judgment
3	The m element is slightly more important than the n element	1/3	The n element is slightly more important than the m element
5	The element m is more important than the element n	1/5	The element n is more important than the element m
7	The m element is significantly more important than the n element	1/7	The element n is significantly more important than the element m
9	The element m is definitely more important than the element n	1/9	The element n is definitely more important than the element m

Scale ω_{nm} represents the weight between different three-level indicators within the same two-level indicator, that is, the importance of elements n and m compared to each other. In this sense, the judgment matrix for the importance weights of the three-level indicators under each two-level indicator can be obtained, set as *M*. The judgment matrices *M* for physical investment, emotional investment, test ability, and application capability indicators are determined as follows:

$$\begin{bmatrix} 1 & 1/7 \\ 7 & 1 \end{bmatrix}、\begin{bmatrix} 1 & 3 & 1/4 \\ 1/3 & 1 & 1/5 \\ 4 & 5 & 1 \end{bmatrix}、\begin{bmatrix} 1 & 1/5 \\ 5 & 1 \end{bmatrix}、\begin{bmatrix} 1 & 1/3 & 5 \\ 3 & 1 & 7 \\ 1/5 & 1/7 & 1 \end{bmatrix}$$

After obtaining the judgment matrix, the required solution satisfies the eigenvalues of $MW = \lambda_{max} W$ and weight vector *W*. Firstly, it is necessary to verify whether *M* has consistency, that is, whether λ_{max} is equal to n. The method is to introduce the formula: $CR = CI / RI$, to determine whether *M* has passed the consistency test by judging the average random consistency index. Among them, $CI = \frac{\lambda_{max} - n}{n-1}$. After calculation, CR can be obtained that: when $CR < 0.1$, it indicates that matrix *M* has passed the consistency test; when $CR \geq 0.1$, if *M* did not pass the test, experts were needed to adjust the weights until it passed the test.

The eigenvalues of four judgment matrices were calculated in Matlab software, with maximum values of 2, 3.0858, 2, and 3.0649, corresponding to eigenvectors of $(0.1414, 0.9899)$, $(0.3143, 0.1403, 0.9389)$, $(0.1961, 0.9806)$, and $(0.3928, 0.9140, 0.1013)$. Among them, the values in the feature vectors correspond to the weights of each of the four two-level indicators and the three-level indicators. After normalizing them, the weights of each indicator are obtained as shown in Table 3.

Table 3
Normalized Weight Values of Three-level Indicators

Three-level indicators	c_1	c_2	c_3	c_4	c_5	p_1	p_2	p_3	p_4	p_5
Weight	0.1250	0.8750	0.2255	0.1007	0.6738	0.1667	0.8333	0.2790	0.6491	0.0719

According to empirical practice, the RI indicators of the second-order and third-order matrices are assigned values of 0 and 0.52, respectively. Based on this, the CR values of the four judgment matrices are calculated to be 0, 0.0825, 0, and 0.0624, all of which are less than 0.1. It proves that all four judgment matrices have passed the consistency test, indicating that the expert's assignment of importance between the third-order indicators meets the logical requirements of AHP.

Evaluation of Chinese Learning Efficiency

Due to the different characteristics of indicators, there are significant differences in their assigned values. Therefore, this paper standardizes the raw data of the three-level indicators under each two-level indicator. The processing method is to use the Min-max normalization method to perform a linear transformation on the original data, so that the original data of learning investment c_t and learning performance p_k are mapped to c_t^* value in interval $[0,1]$ through normalization. The calculation formula is: $c_t^* = \frac{c_t - c_t^{min}}{c_t^{max} - c_t^{min}}$, $p_k^* = \frac{p_k - p_k^{min}}{p_k^{max} - p_k^{min}}$. So, the formula for calculating the value coefficient becomes Equation (4):

$$V = \frac{\sum_{k=1}^{n} \alpha_{ik} p_k^*}{\sum_{t=1}^{m} \omega_{jt} c_t^*} \tag{4}$$

According to equation (4), the value coefficient of Chinese learning efficiency for the entire sample can be calculated.

Descriptive Statistical Analysis

Firstly, provide a basic description of the entire sample data, as shown in Table 4.

Table 4
Descriptive Statistical Results of Three-level Indicators and Value Coefficients

	Mean value	Median	Maximum value	Minimum value	Standard deviation
c_1	200.1449	60	3000	0	516.5490
c_2	24.5217	15	200	0	41.6175
c_3	3.0580	3	5	1	0.8023
c_4	3.1014	3	5	1	0.7697
c_5	3.1594	3	5	1	0.9014
p_1	62.6957	61	92	50	9.8806
p_2	71.0870	72	95	50	9.0257
p_3	2.6377	3	5	1	0.8570
p_4	1.5362	1	4	1	0.6983
p_5	1.7101	2	4	1	0.8419
V	1.1820	1.1472	2.5337	0.3818	0.4830

Due to the large sample size, the efficiency value coefficients of Chinese language learning for all international students are not listed. According to statistics, the maximum and minimum values of the value coefficient are 2.5337 and 0.3818, respectively, with the former being more than six times higher than the latter. The average value coefficient is 1.1820, which is greater than 1, indicating that overall, international students have a higher efficiency in learning Chinese.

Additionally, samples with a value coefficient greater than 1 and less than 1 accounted for 65.25% and 34.75% respectively, indicating that the proportion of samples with a value coefficient greater than 1 exceeded 60%, indicating that the majority of international students have a high efficiency in learning Chinese. Among them, 8.49% of the respondents had a value coefficient greater than 2, indicating that a small number of international students have very high efficiency in learning Chinese.

Conclusion

This paper investigates the investment and learning performance of international students from three universities in Guangzhou who come to China to learn Chinese. The VE method is employed to calculate the value coefficient of Chinese learning efficiency for this group of international students, and evaluations are made from five dimensions: gender, intercontinental attributes, urban-rural attributes, personality, and learning objectives. From the value coefficient of Chinese language learning, it can be seen that over 60% of international students studying in China have a higher efficiency in learning Chinese. The above evaluation results can provide

some inspiration for Chinese language learning for international students studying in China. Special attention should be paid to international students with a value coefficient less than 1, in order to gain a deeper understanding of their learning engagement, performance deficiencies, and imbalances. It's wise to analyze the reasons for the relatively low value coefficient of learning efficiency and find countermeasures.

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