Research on the Construction of Digital Literacy Evaluation Index System for Pre-service International Chinese Teachers

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Abstract: This paper aims to explore the construction of a digital literacy evaluation index system for pre-service international Chinese language teachers. Through comprehensive literature analysis, survey analysis, and data validation, the study delves deeply into the digital literacy of pre-service international Chinese language teachers. By analyzing current challenges and integrating research findings from both domestic and international sources, the study defines the connotation of digital literacy for international Chinese language teachers and constructs an evaluation system comprising four dimensions (digital technology application ability, digital technology teaching ability, digital technology research and learning ability, and digital technology awareness and attitude) and 15 specific indicators. The rationality and effectiveness of the evaluation system were validated through questionnaire surveys and data analysis. This research not only promotes the enhancement of digital literacy among pre-service international Chinese language teachers and enriches the theoretical system of teacher digital literacy evaluation, but also provides strong support for the digital development in the field of international Chinese language education.

Keywords: International Chinese Language Teachers; Digital Literacy; Evaluation System; Pre-service

1. Introduction

In the context of the flourishing digital economy, the rapid advancement and widespread application of digital technology have made mastering digital skills an essential part of daily work and study. Digital knowledge and information, as the core driving forces of the digital economy, have given rise to numerous creative digital products and services. In this era, the ability to acquire, disseminate, organize, and innovate information through digital media is particularly important. "Digital literacy" has become a core skill that enables individuals to stand out in a competitive environment. Only by mastering solid digital skills and literacy can people fully tap into the immense potential of data and truly enjoy the various conveniences brought about by digitalization.

To promote the digitalization of education, various countries and regions around the world have conducted research on digital literacy. In 2017, the European Commission launched a key research project called "The Digital Competence Framework for Educators (DigCompEdu)." [1] Its main goal is to define the digital competences required by teachers and educators and to promote the development of these competences. The DigCompEdu framework includes six areas of digital competence, supported by a solid theoretical foundation. It not only guides decision-making and research work at various educational levels but also enables individuals and institutions to accurately assess their current status and future needs [2]. In 2017, the Norwegian Centre for ICT in Education released the "Professional Digital Competence Framework for Teachers," which includes seven dimensions. This framework aims to help teachers effectively integrate resources in digital environments, manage learning processes, promote interaction and communication, understand the role of digital technology in society, adhere to ethical principles, lead learning, and apply pedagogy and subject didactics [3]. In 2020, JISC (Joint Information Systems Committee) released the "Digital Capabilities Framework," which includes six key elements. These elements are designed to support various individual roles (including educators and students) in assessing and enhancing their digital skills within

educational institutions and different environments [4]. In 2022, Ireland released the "New Strategy" based on its own context and national conditions, drawing on the EU's "Digital Education Action Plan (2021-2027)." The "New Strategy" emphasizes the importance of innovatively integrating digital technology in teaching, learning, and assessment. It focuses on addressing emerging digital technology issues in the education sector and is built upon three main pillars. [5] In 2023, the Ministry of Education of China defined the connotation of teachers' digital literacy in its released educational industry standard, "Teachers' Digital Literacy." The standard states that "teachers' digital literacy is the awareness, ability, and responsibility of teachers to appropriately utilize digital technology to acquire, process, use, manage, and evaluate digital information and resources, identify, analyze, and solve educational and teaching problems, and optimize, innovate, and transform educational and teaching activities." The standard covers five dimensions: digital awareness, digital technology knowledge and skills, digital application, digital social responsibility, and professional development. [6]

Through a comprehensive analysis of existing research on teachers' digital literacy, it is evident that international discussions on the indicators and dimensions of digital literacy began relatively early. In contrast, domestic research in this field is still relatively insufficient. Although many scholars have divided dimensions and summarized indicators of teachers' digital literacy from various perspectives such as connotation, framework, and system [7-10], the existing research covers a broad range but lacks detailed specificity. This, to some extent, limits its practical guidance significance.

Digital technologies, represented by multimedia technology and internet technology, are driving the continuous evolution and innovation of international Chinese language education. These advancements have not only given rise to new educational forms, teaching models, and products but have also brought new opportunities and challenges for the development of digital literacy among international Chinese language teachers. For pre-service international Chinese language teachers, the ability to integrate the concept of digital literacy into their daily teaching, effectively utilize digital tools to conduct teaching activities, and use digital media to acquire, disseminate, organize, and create information is crucial to their future career development.

Koehler et al. (2012) argue that providing a framework is not enough: "Frameworks must be tested in the real world, where it becomes crucial to develop sensitive tools that align with theory and measure what they are intended to measure" (p. 17) [11].” Laanpere (2019) also points out that "developing assessment tools to monitor digital literacy is important" (p. 5) [12]. Currently, the digitalization of international Chinese language education has garnered widespread attention in academia. However, a standard for digital competencies and an evaluation system specifically for international Chinese language teachers has yet to be established [13]. Therefore, constructing a digital literacy evaluation index system specifically for pre-service international Chinese language teachers is crucial. This system will use standardized criteria to accurately assess the digital literacy levels of these teachers. Not only can this provide higher education institutions with clear reference standards for cultivating digital literacy, promoting goal-oriented training and the dissemination of digital literacy, and addressing current research gaps, but it can also offer a practical guide for pre-service international Chinese language teachers to enhance their digital literacy. Given this, this paper proposes the research topic of constructing a digital literacy evaluation index system specifically for pre-service international Chinese language teachers, based on a comprehensive analysis and synthesis of previous literature. The study aims to explore and address the following core questions:

1. What is the digital literacy of international Chinese language teachers?
2. What is the evaluation index system for the digital literacy of pre-service international Chinese language teachers?
3. What is the reliability and validity of this evaluation index system?

This study will use survey analysis and data validation methods to deeply investigate and answer these research questions.

2. The Connotation of Digital Literacy for

International Chinese Language Teachers

2.1 The Connotation of Digital Literacy

Currently, there is no consensus in academia on the concept of digital literacy. The scholar who first introduced the concept of digital literacy is Yoram (2004). Yoram subdivided digital literacy into five literacies: "visual literacy," "re-creation literacy," "branching literacy," "information literacy," and "social-emotional literacy."[14] Subsequently, Paul Gilster (2007) suggested that the ability to understand and use various digital resources and information presented by computers constitutes the connotation of digital literacy [15]. The European Union defines digital literacy essentially as digital competence, emphasizing the confident and critical use of digital technology. This competence spans various aspects of learning, work, and social activities, and includes three major literacies (information literacy, data literacy, media literacy), four key abilities (effective communication and collaboration, digital content creation, problem-solving, critical thinking), and two major awareness areas (health and safety in digital environments, awareness of intellectual property protection) [2]. JISC's definition of digital literacy is similar to that of the European Union. JISC believes that digital literacy is the ability of individuals to adapt to personal life, learning, and work in a digital society [16].

In summary, this paper defines digital literacy as the cognitive understanding of digital technology, the ability to critically use digital technology, and the related awareness in various life domains such as learning, employment, work, and social interactions. This ability includes effectively finding, producing, integrating, communicating, utilizing, and creating digital resources, as well as the awareness of protecting personal privacy and respecting intellectual property in a digital environment. More specifically, digital literacy encompasses the following four core aspects: digital knowledge, the ability for digital learning and innovation, critical thinking, and a sense of responsibility towards the information society.

2.2 The Connotation of Digital Literacy for International Chinese Language Teachers

Despite the extensive exploration of the connotation of teachers' digital literacy by scholars both domestically and internationally, there is still no consensus in academia on its definition. According to Yu Kehua (2023), teachers' digital literacy is a core professional competence in the digital age and plays a crucial role in cultivating students' digital abilities[17]. Fang Zifan (2023) pointed out that teachers' digital literacy is a comprehensive set of abilities. While definitions may vary, they all fundamentally refer to how teachers effectively use technology to conduct educational activities and achieve teaching objectives[18]. In 2020, the International Society for Chinese Language Teaching released the "Professional Standards for International Chinese Language Teachers" (hereinafter referred to as the "Competency Standards")[19],The standards clearly state that teachers should possess the following abilities:

1. Consciously integrate information technology with the Chinese teaching process.
2. Appropriately select information-based teaching methods according to actual teaching needs and the characteristics of students.
3. Ability to design and create teaching materials such as courseware.
4. Ability to use resource libraries in teaching.
5. Ability to manage and conduct blended Chinese teaching.
6. Innovation awareness.
7. Basic information ethics.

According to Li Xiaodong et al. (2022), the digital competencies of international Chinese language teachers include three main aspects: digital knowledge, application abilities (digital technology skills, digital teaching skills, digital research skills, and digital teaching innovation skills), and digital awareness [4]. Hui Tiangang (2023) proposed that the digital literacy of international Chinese language teachers mainly involves three dimensions: understanding and recognizing the role of digital technology in teaching, using and optimizing digital technology, and producing and creating digital resources [20].

Based on the aforementioned research, this paper defines the digital literacy of international Chinese language teachers as the ability to appropriately use digital technology to design, implement, manage, and evaluate Chinese language teaching. This includes the ability to develop, create, and effectively utilize digital Chinese teaching resources, optimize and innovate Chinese teaching activities, and, in the process, consider intellectual property

protection and information security, capabilities, and sense of responsibility. demonstrating the corresponding awareness,

Table 1. Digital Literacy Indicator System for Pre-Service International Chinese Language Teachers

No.	Dimension	Indicator	Explanation	Reference
1	Digital Technology Application Ability	Proficiency in Digital Tools	Ability to use basic digital tools, such as multimedia equipment, digital office software, various digital teaching software, and smart teaching platforms	Fang & Yang
		Digital Information Processing Ability	Ability to perceive, acquire, collect, analyze, understand, evaluate, use, and share information and data related to international Chinese teaching	Fang & Yang, Wang
2	Digital Technology Teaching Ability Digital Student	Digital Technology Teaching Ability Digital Student	Ability to use digital teaching software and smart teaching platforms to analyze students' learning readiness	Fang & Yang
		Digital Teaching Design Ability	Ability to use digital technology to design international Chinese teaching tailored to student analysis and teaching objectives	Fang & Yang, Wang
		Digital Teaching Implementation Ability	Ability to select appropriate digital teaching methods for online, offline, and blended teaching and management based on student analysis and teaching objectives	Fang & Wang
		Digital Teaching Evaluation Ability	Ability to use digital tools for diverse evaluations involving multiple participants, including formative, summative, and diagnostic assessments	Fang & Wang
		Digital Teaching Resource Development Ability	Ability to design, create, manage, protect, and use various international Chinese teaching resources, such as handouts and teaching aids, using digital resource libraries	Fang & Wang
3	Digital Technology Research and Learning Ability	Digital Autonomous Learning Ability	Ability to independently learn the latest digital skills, reflect on methods and strategies, and identify research issues in international Chinese education	Fang & Wang
		Digital Collaborative Learning Ability	Ability to communicate, share, and collaborate with others through digital channels, build study groups, and promote professional development	Fang & Yang, Wang
		Digital Research and Innovation Ability	Ability to reflect on practical experiences and innovate digital teaching methods, teaching designs, and teaching resources in international Chinese education	Fang & Wang
		Digital Content Critical Ability	Ability to use critical thinking to deeply analyze information in international Chinese education, not blindly accept superficial information, and analyze problems from multiple perspectives	Fang & Wang
4	Digital Technology Awareness and Attitude	Digital Value Recognition	Recognition of the latest policies, standards, and industry information related to international Chinese teachers' digital competencies, development of digital thinking, and enhancement of digital literacy	Fang & Wang
		Digital International Awareness	Willingness to integrate global scenarios and perspectives into digital teaching, enhance cross-cultural awareness among international Chinese education talents, and cultivate an international vision	Fang
		Digital Security Awareness	Awareness of protecting the security of work, teaching, and research data and privacy	Fang & Yang
		Digital Ethics and Morality	Basic information ethics awareness, willingness to consciously abide by laws and ethical norms, respect intellectual property rights, and use data and information safely, legally, and responsibly	Fang & Yang, Wang

Table 2. Survey Questionnaire on Digital Literacy of Pre-service International Chinese Language Teachers

Dimension	Question No.	Indicator	Question Item
Digital Technology Application Ability	DT1	Proficiency in Digital Tools	I can use basic digital tools such as interactive whiteboards, WPS, Office, Baidu Netdisk, PS, Todoist, Zoom, Tencent Meeting, Rain Classroom, DingTalk, Wenyan Yixin, International Chinese Smart Education System, etc.
	DT2	Digital Information Processing Ability	I can perceive, acquire, collect, analyze, understand, evaluate, use, and share information and data related to international Chinese teaching through the internet with colleagues, students, or peers.
Digital	DTT1	Digital Student	I can use digital teaching software and smart teaching platforms such as

Technology Teaching Ability		Analysis Ability	Superstar Learning, Rain Classroom, Classin, Neukol, and International Chinese Smart Teaching System to analyze students' learning readiness.
	DTT2	Digital Teaching Design Ability	Based on student analysis and teaching objectives, I can use digital technologies such as PPT, mind maps, word clouds, videos, animations, WordWall, and AI to design suitable international Chinese teaching.
	DTT3	Digital Teaching Implementation Ability	I can use digital methods such as online Q&A, voting, group discussions, random answers, quick responses, and live streaming to conduct and manage online, offline, and blended teaching based on student analysis and teaching objectives.
	DTT4	Digital Teaching Evaluation Ability	I can use evaluation tools provided by various teaching software and online platforms, such as quick quizzes, student e-portfolios, rubric functions, and electronic exams, to conduct diverse evaluations involving multiple participants, including formative, summative, and diagnostic assessments.
	DTT5	Digital Teaching Resource Development Ability	I can design, create, manage, protect, and use various digital international Chinese teaching resources, such as e-textbooks, e-lesson plans, online courses, interactive games, teaching aids, and test banks.
Digital Technology Research and Learning Ability	DTR1	Digital Autonomous Learning Ability	I can independently learn the latest digital skills, reflect on methods and strategies, and identify research issues in international Chinese education, such as the application scenarios of AI digital humans in language teaching and designing AI-assisted teaching content that meets learners' needs and characteristics.
	DTR2	Digital Collaborative Learning Ability	I can use digital channels to communicate, share, and collaborate with colleagues and peers, build study groups, and promote professional development.
	DTR3	Digital Research and Innovation Ability	I can use existing digital technology to develop new solutions to problems encountered in Chinese language teaching, and innovate digital teaching methods, teaching designs, and teaching resources in international Chinese teaching.
	DTR4	Digital Content Critical Ability	When encountering and handling digital content (such as online information, electronic documents, digital media, etc.), I can critically evaluate the authenticity, reliability, validity, and value of digital information to make informed decisions.
Digital Technology Awareness and Attitude	DTA1	Digital Value Recognition	In daily teaching, I closely follow the latest policies on teachers' digital capabilities released by national and industry organizations and focus on integrating these standards into teaching practice to improve my digital teaching skills.
	DTA2	Digital International Awareness	I am willing to integrate diverse global scenarios and perspectives into digital teaching, hoping to enhance the cross-cultural awareness of international Chinese education talents by introducing cultural elements from around the world into the learning process.
	DTA3	Digital Security Awareness	I always prioritize data security, strictly comply with relevant data protection regulations, ensure that data collected during work, teaching, and research is properly stored and only used for clearly informed purposes.
	DTA4	Digital Ethics and Morality	I always uphold a high sense of responsibility towards data and information, strictly adhere to relevant laws and regulations, respect others' intellectual property rights, and do not plagiarize, misuse, or illegally distribute others' ideas and achievements.

3. The Indicator System for Digital Literacy of Pre-Service International Chinese Language Teachers

3.1 The Construction of the Digital Literacy Evaluation Index System for Pre-Service International Chinese Language Teachers

Wang Henan et al. (2022) divided the digital competencies of international Chinese language teachers into three competency levels, six practical dimensions, and 18 digital competencies [21]. Fang Zifan (2023), aligning with the "Competency Standards," constructed a digital literacy framework for international Chinese language teachers, comprising five primary indicators and 19 secondary indicators [18]. This paper draws on the essence of these scholars' research, based on the previously summarized connotation of digital literacy for international Chinese language teachers. Combining the digital literacy evaluation index system [16] for university teachers constructed by Yang Shuang (2019) and considering the specificity of pre-service international Chinese language teachers, a digital literacy indicator system for pre-service international Chinese language teachers is constructed. This system includes 15 indicators distributed across four key dimensions: digital technology application

ability, digital technology teaching ability, digital technology research and learning ability, and digital technology awareness and attitude. The specific indicators covered by each dimension, along with their explanations and the main reference literature, are detailed in Table 1.

3.2 Survey Questionnaire on Digital Literacy of Pre-Service International Chinese Language Teachers

In this study, we have converted the digital literacy indicator system for pre-service international Chinese language teachers into a survey questionnaire. In the design of the questionnaire, we strive for concise language expression to clearly convey the meaning of each indicator element. This allows the pre-service international Chinese language teachers participating in the survey to easily understand and evaluate their own level of digital literacy accordingly. The questionnaire uses a quantitative scoring method, allowing respondents to express their understanding and evaluation of each indicator. To collect data widely, this study employs an electronic questionnaire distributed to pre-service international Chinese language teachers. A specific example of the survey questionnaire is detailed in Table 2.

4. Data Collection and Processing

In this study, a total of 329 questionnaires were distributed via Questionnaire Star, of which 270 were valid. To verify the reliability and validity of the evaluation index system, this study first employed Exploratory Factor Analysis (EFA) and then used Confirmatory Factor Analysis (CFA) to conduct a comprehensive reliability and validity test on the collected data. This process not only helps assess the structural rationality of the evaluation index system but also ensures the reliability of the measurement tools and the validity of the measurement results, thereby providing a solid theoretical and methodological foundation for subsequent research.

4.1 Exploratory Factor Analysis (EFA)

In this study, SPSS 26.0 software will be used to perform Exploratory Factor Analysis (EFA) on the collected data. Before conducting EFA, we must assess whether there is correlation among the variables and whether the data is suitable for factor analysis. Therefore, we first performed the KMO (Kaiser-Meyer-Olkin) test and Bartlett's Test of Sphericity on the collected data.

The KMO test value should typically be greater than 0 and less than 1, with an ideal value approaching 1. The closer the KMO value is to 1, the higher the correlation among the variables, making them suitable for factor analysis. Bartlett's Test of Sphericity is a statistical test that checks whether the variables in the dataset are significantly correlated. If the test statistic is large and the corresponding P-value is less than 0.05, it indicates that there is significant correlation among the variables, making them suitable for factor analysis.

After testing, the collected predictive data in this study was found to be suitable for factor analysis. The specific results are shown in Table 3.

Table 3. KMO and Bartlett's Test for Survey Data

Test		Value
KMO		.912
Bartlett's Test of Sphericity	Approx.Chi-Square	2055.567
	df	105
	Sig.	.000

From Table 4, it can be seen that the KMO test value for the data is as high as 0.912, which is very close to 1. This indicates a strong correlation among the variables, making it highly suitable for Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA). Additionally, the Bartlett's Test of Sphericity shows a significance level well below the standard threshold of 0.05, leading us to reject the null hypothesis—that the correlation matrix is an identity matrix. This result further confirms the significant correlation among the variables, thereby validating the appropriateness of conducting factor analysis.

4.1.1 Total variance explained

Based on the performance of the collected data in the KMO and Bartlett's tests, we can use Principal Component Analysis (PCA) for factor analysis. In PCA, we identified four factors according to the digital literacy indicator system for pre-service international Chinese language teachers mentioned above. After PCA, the cumulative variance contribution rate of these factors is as high as 71.075%, which means that the information loss during the analysis is relatively low, and the data has good representativeness. After factor rotation, the

cumulative variance contribution rate remains stable at 71.075%, further validating the rationality of the principal component extraction method. The total variance explained by the survey data in this study is shown in Table 5.

Table 5. Total Variance Explained for Survey Data

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	6.273	41.823	41.823	6.273	41.823	41.823	4.190	27.930	27.930
2	1.953	13.021	54.844	1.953	13.021	54.844	3.034	20.228	48.158
3	1.801	12.005	66.849	1.801	12.005	66.849	2.798	18.651	66.809
4	.634	4.225	71.075	.634	4.225	71.075	.640	4.266	71.075
5	.524	3.490	74.565						
6	.479	3.195	77.760						
7	.461	3.072	80.832						
8	.449	2.996	83.828						
9	.429	2.857	86.686						
10	.390	2.598	89.284						
11	.371	2.474	91.758						
12	.353	2.352	94.110						
13	.305	2.031	96.141						
14	.297	1.983	98.124						
15	.281	1.876	100.000						

4.1.2 Rotated component matrix

By applying the varimax rotation method to the factors, we sorted them according to the size of the coefficients. To ensure that each observed variable does not span multiple latent variable dimensions, we removed all coefficients less than 0.4 from the common factor matrix. This step helps to improve the clarity and interpretability of the factor structure. The rotated component matrix is presented in Table 6 of the document.

Table 6. Rotated Component Matrix of Observed Variables

	Component			
	1	2	3	4
DT1	.831			
DT2	.799			
DTT1		.763		
DTT2		.757		
DTT4		.714		
DTT3		.701		
DTT5		.674		
DTR1			.808	
DTR3			.806	
DTR2			.804	
DTR4			.790	
DTA1				.822
DTA2				.820
DTA3				.765
DTA4				.764

From the analysis results in Table 6, it is evident that DT1 to DT2, DTT1 to DTT5, DTR1 to DTR4, and DTA1 to DTA4 are all grouped under the same common factor. This indicates that none of the observed variables pertain to other latent variables. This finding implies that there is a high correlation among the observed variables within the same dimension. Moreover, these variables can effectively explain the variations within their respective dimensions,

accurately reflecting the characteristics and connotations of each dimension.

4.2 Confirmatory Factor Analysis (CFA)

The aforementioned Exploratory Factor Analysis (EFA) confirmed that the scale used in this study has a certain degree of reliability. To further validate its validity, we need to conduct Confirmatory Factor Analysis (CFA). The analytical tool used in this study is AMOS 26.0 software. We used AMOS to construct an analytical model. The specific structure of the model is shown in Figure 1.

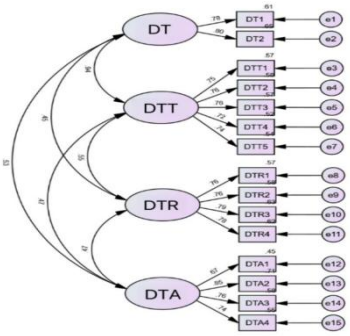

Figure 1. Confirmatory Factor Analysis Model

The model consists of four latent variables, 15 observed variables, and 15 error variables associated with the observed variables. Below, we will examine the validity of the scale in terms of structural validity, convergent validity, and discriminant validity. However, before conducting the Confirmatory Factor Analysis (CFA), we must determine whether the analytical model is significant. By calculating the ratio of the unstandardized estimate of the regression coefficients (i.e., Regression Weights) to their standard error (S.E.), we obtain the critical ratio (C.R.). The C.R. value represents the statistical significance of the model path coefficients. The estimated loadings between the observed variables and their corresponding latent variables in this study are shown in Table 7.

When the absolute value of the C.R. exceeds 1.96, the path coefficient is significant at the 0.05 significance level, indicated by ""; if the absolute value of the C.R. exceeds 2.58, it is significant at the 0.01 significance level, indicated by ""; and if the absolute value of the C.R. exceeds 3.29, the path coefficient is significant at the 0.001 significance level, indicated by "". According to the data in Table 7, the analysis model in this study shows good significance. Therefore, the model will be tested in terms of structural validity, convergent validity, and discriminant validity in the following sections.

Table 7. Estimated Loadings Between Observed Variables and Corresponding Latent Variables

Dimension→Indicator	Unstandardized Estimate	S.E.	C.R.	P-value
DT→DT1	1.000			
DT→DT2	.980	.074	13.235	***
DTT→DTT1	1.000			
DTT→DTT2	.944	.076	12.476	***
DTT→DTT3	.987	.080	12.401	***
DTT→DTT4	.914	.077	11.796	***
DTT→DTT5	.907	.075	12.017	***
DTR→DTR1	1.000			
DTR→DTR2	.982	.082	12.013	***
DTR→DTR3	1.004	.080	12.485	***
DTR→DTR4	1.024	.083	12.365	***
DTA→DTA1	1.000			
DTA→DTA2	1.425	.127	11.234	***
DTA→DTA3	1.211	.115	10.537	***
DTA→DTA4	1.216	.118	10.274	***

4.2.1 Structural validity

Structural validity refers to the model's goodness of fit, which measures the discrepancy between the actual data and the theoretical model. This study assesses the model's fit using both absolute fit indices (including $\chi 2$/DF, GFI, SRMR, RMSEA) and incremental fit indices (including NFI, IFI)[22] . The chi-square value ($\chi 2$) is a crucial indicator for evaluating the overall model fit and is primarily used to compare whether there is a significant difference between the actual observed data and the expected data. Specifically, if the chi-square value is large, it indicates a considerable discrepancy between the actual observed data and the expected data, which may suggest that

the two samples are not from the same population or that the sample does not conform to an expected distribution. However, there is no unified standard for the specific value of χ2[23]. Degrees of freedom (Df) reveal the relationship between the number of effective parameters and the parameters to be estimated in the model. The ratio of chi-square to degrees of freedom (χ2/Df) can serve as another indicator of model fit, with smaller ratios indicating a better fit between the model and the data. Generally, when the χ2/Df ratio is less than 3, the model is considered to have a good fit. Additionally, the Goodness of Fit Index (GFI) is an important evaluation criterion; the higher the GFI value, the better the model fit, with values generally required to exceed 0.9. The Standardized Root Mean Square Residual (SRMR) measures the size of the model residuals, i.e., the part of the data variation that the model fails to explain, with values typically required to be less than 0.1. The Root Mean Square Error of Approximation (RMSEA) is another crucial indicator of model fit, with values between 0.05 and 0.08 generally indicating good fit. Furthermore, the Normed Fit Index (NFI) and the Incremental Fit Index (IFI) are also important standards for evaluating model fit. When these indices exceed 0.9, the model fit is considered good. The specific fit indices for the analysis model in this study are shown in Table 8.

Table 8. Overall Model Fit (Structural Validity) of the Analysis Model

Model Fit Indices	Statistical Value	Optimal Standard Value	Fit Evaluation
χ2	138.926	-	-
DF	84	-	-
χ2/DF	1.654	＜3	Good
RMSEA	.049	<0.05	Acceptable
SRMR	.0510	<0.1	Good
GFI	.972	>0.9	Good
NFI	.934	>0.9	Good
IFI	.973	>0.9	Good

Based on the data analysis results in Table 8, the model fit in this study generally meets the predefined standards. This result indicates that the actual data shows a good fit with the theoretical model, reflecting a high level of internal quality in the model.

4.2.2 Convergent validity

Convergent validity, also known as convergent validity, is an important indicator that measures the degree to which observed variables within the same dimension belong to their respective dimension. In Confirmatory Factor Analysis (CFA), we assess convergent validity through three key indicators: standardized factor loadings, composite reliability (CR), and average variance extracted (AVE)[24]. Typically, when the standardized factor loadings exceed 0.6, composite reliability (CR) exceeds 0.7, and average variance extracted (AVE) exceeds 0.5, we can consider the convergent validity to be good. Table 9 details the specific values of these indicators in this study and their corresponding evaluation results.

Table 9. Convergent Validity of the Analysis Model

Dimension→ Indicator	Standardized Estimate	CR	AVE
DT→DT1	.778		
DT→DT2	.803	.769	.625
DTT→DTT1	.752		
DTT→DTT2	.762		
DTT→DTT3	.758		
DTT→DTT4	.724		
DTT→DTT5	.736	.863	.557
DTR→DTR1	.756		
DTR→DTR2	.761		
DTR→DTR3	.793		
DTR→DTR4	.785	.857	.599
DTA→DTA1	.668		
DTA→DTA2	.845		
DTA→DTA3	.764		
DTA→DTA4	.739	.842	.572

From Table 9, it can be seen that all observed variables have standardized factor loadings exceeding the threshold of 0.6, composite reliability values higher than the standard of 0.7, and average variance extracted values above 0.5. These data indicate very good convergent validity. Collectively, these indicators demonstrate a high level of consistency and reliability between the variables within each dimension, further confirming the validity of the scale.

4.2.3 Discriminant validity

Discriminant validity, also known as divergent validity, is an indicator that assesses whether there are significant differences between different dimensions. In other words, it ensures that each dimension represents a unique concept and effectively avoids estimation errors due to

high correlations between dimensions. To evaluate discriminant validity, we compare the square root of the Average Variance Extracted (AVE) for each dimension (denoted as $\sqrt{\text{AVE}}$) with the correlation coefficients between dimensions (denoted as r). When the value of $\sqrt{\text{AVE}}$ is greater than the correlation coefficient r, it indicates that there is a clear distinction between the dimensions, meaning there is no collinearity problem [25]. The discriminant validity of this study is shown in Table 10.

Table 10. Discriminant Validity of the Study

Dimension	1	2	3	4
1. DT	.791			
2. DTT	.537	.746		
3. DTR	.450	.545	.774	
4. DTA	.529	.469	.470	.757

Based on the data shown in Table 10, the values of $\sqrt{\text{AVE}}$ for all dimensions are greater than the correlation coefficients r. This result indicates that the scale in this study has good discriminant validity, and each dimension has sufficient distinctiveness from one another.

5. Research Conclusion

After an exhaustive discussion of the core concepts and deeper meanings of digital literacy, this study comprehensively reviewed the cutting-edge research on digital literacy evaluation index systems both domestically and internationally. Building on previous research, we constructed an evaluation index system for the digital literacy of pre-service international Chinese language teachers.This system includes four dimensions and covers 15 specific indicators. To validate its rationality, we employed a combination of questionnaire surveys and quantitative analysis. The results indicate that the evaluation index system developed in this study demonstrates good reliability and validity.

This study suggests that to promote the development of digital literacy among pre-service international Chinese language teachers, assessments should focus on four key areas: digital technology application ability, digital technology teaching ability, digital technology research and learning ability, and digital technology awareness and attitude. By formulating effective training programs to enhance digital literacy in these areas, pre-service international Chinese language teachers can improve their digital literacy, further strengthening their digital capabilities in future work and teaching, as well as their ability to impart digital literacy and skills to their students.

This study not only provides a unified standard for evaluating the digital literacy of teachers who are about to engage in international Chinese education in China but also advances existing research with significant practical and theoretical value. In the future, our research will focus on the performance of this evaluation index system in practical applications. Through continuous field surveys and feedback collection, we will make ongoing adjustments and optimizations to the evaluation index system to ensure it is more refined and aligned with practical application needs.

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