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Research on the Construction and Systematic Enhancement Path of Digital Competence for Postgraduates in International Chinese Education Under the Background of AI

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With the rapid advancement of artificial intelligence (AI) technology, international Chinese language education is undergoing profound digital transformation, imposing new and heightened demands on practitioners' digital competencies. This study focuses on graduate students in international Chinese language education—the future core teaching workforce—employing large-scale questionnaires and interviews to explore effective pathways for systematically enhancing their digital capabilities in the AI era. The research aims to provide theoretical insights and practical solutions for universities to innovate talent cultivation models and empower graduate students in international Chinese language education to address the challenges of educational intelligence.

Keywords: artificial intelligence, international Chinese education, digital competence, enhancement

Introduction

Digital literacy, as a vital component of core competencies in the information age, has seen its conceptual definition continually refined alongside advancements in technology and educational practices. Academic communities both internationally and domestically have constructed theoretical frameworks for digital literacy from multiple dimensions, providing a theoretical foundation for further defining digital literacy within the field of international Chinese language education.

Zanda, Alise, and Gatis (2021, p. 51) defined digital competence from a higher education perspective as "an individual's comprehensive literacy in utilizing digital technologies to acquire, process, and create information, and effectively apply it across diverse contexts", emphasizing its integrative role in learning, collaboration, and innovation. Ewa, Annika, Mona, and Pia (2022) noted through a literature review that teachers' professional digital literacy must encompass three dimensions: "technical operation, instructional integration, and ethical judgment". The dimension of "ethical judgment" addresses emerging issues such as data privacy and algorithmic fairness, thereby infusing critical thinking into digital literacy.

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Additionally, Ferrari, Punie, and Redecker (2012) proposed a "three-dimensional framework" for digital competence, comprising the instrumental dimension (use and management of digital tools), the cognitive dimension (evaluation and creation of digital information), and the social dimension (collaboration and communication in digital environments). This framework transcends the narrow perspective of "technical operation", providing a theoretical paradigm for subsequent research. Gragera, Almenara, and Rodriguez (2023), building upon the EU framework, refined the digital competencies for language teachers, emphasizing the deep integration of these competencies with teaching practices. Their definition of digital competencies highlights systematic and interdisciplinary approaches.

In contrast, Chinese academia has developed a more targeted definition of digital literacy by extensively incorporating the nature and characteristics of "education". Wang Henan, Liu Dandan, Ren Qianqian, and Li Xiaodong (2022) first proposed a "three-tier competency model" for international Chinese language teachers: the foundational level (operating technical tools), the integration level (blending digital resources with teaching), and the innovation level (data-driven instructional improvement), emphasizing the theoretical orientation that "technology serves teaching". Building upon this framework in the context of the digital and intelligent era, Li Baogui and Li Hui (2024) further expanded the concept, proposing a composite model where "digital competency = technological literacy + subject knowledge + intercultural thinking". This model underscores the distinctiveness of international Chinese language education—digital competency is not merely about applying technology but must also integrate the principles of second language acquisition and the demands of intercultural communication.

Literature Review

Research on Digital Competence

In the field of higher education, Zanda et al. (2021) found through empirical research that university faculty and students exhibit a "tool-oriented" tendency in their perception of digital literacy, meaning they overemphasize technical operations while neglecting critical thinking and innovative application. This phenomenon is particularly pronounced in language education. Tsankov and Damyanov (2017) investigated blended learning environments and found that education majors preferred e-learning platforms featuring "personalized learning path recommendations" and "real-time interactive feedback". These findings offer valuable insights for designing digital learning platforms for graduate students in international Chinese education.

In the field of language education, Gragera et al. (2023) analyzed the DigCompEdu framework and found that language teachers exhibit "proficiency in technology application but insufficient pedagogical transformation". Only 38% of teachers can integrate digital tools with language acquisition theory. Ewa et al. (2022) noted in their review that international research on teachers' digital competence has shifted from "competency descriptions" to "development mechanisms". Approaches such as "community practice" and "reflective learning" are now recognized as pathways to enhance these competencies, offering valuable insights for cultivating graduate students in international Chinese language education.

Empirical research indicates that surveys on the digital literacy status of international Chinese language education practitioners reveal: Master's degree students exhibit "adequate foundational skills but weak advanced competencies" (Shi, 2024; Chen, 2024). Gan Rourou's (2023) cross-regional study found that postgraduate students in eastern universities, benefiting from resource advantages, demonstrated significantly higher proficiency in digital tool usage compared to their counterparts in central and western regions. However, no

significant differences were observed in advanced competencies such as “cross-cultural digital resource development”, highlighting issues of homogenization in training models.

Cultivating Digital Competencies in Master’s Students of International Chinese Education

Currently, research on digital competency within the field of international Chinese language education in China primarily focuses on the level of disciplinary development. Studies addressing the cultivation of digital competency among Master’s degree candidates in this field remain limited, exhibiting a certain lack of specificity and systematic approach. Disciplinary-level digital development serves as the foundation for cultivating digital competency. On the policy front, the “International Chinese Education Standards Development Plan (2024-2027)” proposes “building a digital and intelligent system”, driving academia to actively explore pathways for integrating technology with academic disciplines. On June 5, 2025, the Center for Language Education and Cooperation under China’s Ministry of Education officially released the “Reference Framework for Digital Literacy of International Chinese Language Teachers (2025 Edition)”. Yuan Xi and Wu Yinghui (2023) analyzed ChatGPT Plus’s multimodal capabilities, highlighting its potential applications in scenarios such as “cross-cultural communication simulation” and “Chinese grammar correction”, while cautioning against cultural biases and ethical risks.

In terms of theoretical innovation, Li Baogui and Li Hui (2025) proposed a “data-driven” disciplinary development logic. They argued that constructing teaching behavior databases and learner profiling systems could propel international Chinese language education from an “experience-driven” to a “data-driven” approach. This perspective provides the foundational rationale for cultivating graduate students’ digital competencies—namely, the need to develop “data thinking” rather than merely technical operations.

At the practical level, Le Shouhong and Cao Ming (2023) summarized three pathways for digital empowerment: resource digitization (e.g., building multilingual corpora), intelligent teaching (e.g., AI-assisted instructional design), and dynamic assessment (e.g., learning analytics applications), providing an actionable framework for subject digitization.

Research on “Developing Digital Competencies Among Master’s Students in International Chinese Education” can be broadly categorized into two types.

The first type focuses on specialized studies of digital teaching resource application skills. The continuous evolution of AI technology has provided significant conveniences for the professional growth and career development of master's students in international Chinese education. AI-generated teaching resources can substantially enhance teaching efficiency. Yan Fanshu (2024) examined this group’s digital teaching resource application abilities. Surveys revealed clear resource awareness but issues such as insufficient training, limited platform familiarity, and inadequate resource development. Overall application abilities were moderate, with weak advanced integration skills. The study proposed strategies to enhance students’ digital application abilities, including strengthening resource utilization awareness, optimizing curriculum systems, enriching resource libraries, establishing learning communities, and encouraging participation in skills competitions.

The second category involves research on comprehensive frameworks and systematic enhancement of digital competencies. Shi Chunyuan (2024) constructed a six-dimensional framework encompassing digital awareness, digital knowledge, digital learning abilities, digital technical skills, digital teaching competencies, and digital application capabilities. The study indicates that graduate students possess above-average overall digital competencies, yet their digital application abilities (such as resource management and data analysis) are the

weakest. Influencing factors include societal (insufficient policy support), institutional (incomplete curriculum systems), and individual (weak self-directed learning motivation) dimensions. individual (weak self-directed learning motivation). Improvement pathways were proposed at national, institutional, and individual levels, including establishing standards, updating training programs, and strengthening self-directed learning. Chen Guoli (2024) categorizes digital competence into four dimensions: digital application, digital interaction, digital security, and professional development. Using grounded theory and fsQCA analysis, the study identifies issues within the discipline, including insufficient intrinsic motivation, mismatches between talent cultivation and market demands, and imbalances in resource supply and demand. Influencing factors encompass individual (awareness and skills), community (resource sharing), environment (policy and facilities), with interactive effects. Based on this, strategies were proposed to promote self-directed development, establish mutual-aid platforms, and improve top-level design.

Research Design

This study was conducted through a large-scale questionnaire distributed to the general public. The questionnaire comprised four sections: Section One collected participants' basic information, including gender, academic year, age, undergraduate major, and type of institution attended, totaling six questions; Section Two featured a self-report scale assessing the digital competency status of Master's students in International Chinese Education. This section consisted of background inquiries, digital knowledge, digital technical skills, digital teaching abilities, and digital application capabilities, totaling 22 questions; the third section investigated factors influencing digital literacy among international Chinese education master's students. It examined societal, institutional, and personal factors, incorporating multiple-choice ranking questions to explore these influences from diverse perspectives for comprehensive insights. This section comprised 13 questions. The entire questionnaire contained 41 questions.

This survey collected 164 valid questionnaires covering multiple demographic variables including gender, age, current academic/professional stage, undergraduate major, institution type, and professional internship experience. Among respondents, 18 were male (10.98%) and 146 were female (89.02%); by current academic/professional stage: 100 participants (60.98%) were enrolled in Master's programs, 4 (2.44%) were enrolled in doctoral programs, 51 (31.1%) were novice Chinese language teachers with 0-3 years of experience, and 9 (5.49%) were Chinese language teachers with over three years of experience. By age distribution: 4 participants (2.44%) were under 22 years old, 65 aged 23-24 (39.63%), 49 aged 25-26 (29.33%), 23 aged 27-28 (14.02%), 9 aged 29-30 (5.49%), and 14 aged 30 or older (8.54%). Among all participants, 123 individuals (75%) had professional internship experience, while the remaining 41 individuals (25%) lacked such experience.

Data Analysis

Analysis of Digital Competency Dimensions in the Master of International Chinese Education Program

Before assessing participants' digital literacy across various dimensions, we surveyed their usage of digital tools: Among 164 respondents, only 29 (17.6%) never or rarely used AI tools to assist Chinese language teaching; commonly used digital tools or platforms included "PPT/Keynote", "AI writing assistance tools (e.g., Grammarly)", "corpus tools (BCC Corpus)", and "online teaching platforms (e.g., Zoom, Yuke Classroom)".

To illustrate the current state of digital literacy among international Master of Chinese Education students over the past five years, this paper employs descriptive analysis in statistics to present their overall proficiency.

All response options in the questionnaire have been coded numerically as follows: 1 = “Strongly Disagree”, 2 = “Somewhat Disagree”, 3 = “Neutral”, 4 = “Somewhat Agree”, 5 = “Strongly Agree”. By calculating the mean scores for each dimension and its corresponding options, we can determine respondents’ level of agreement with the statements. This enables us to analyze both the overall state of respondents’ digital literacy and the specific performance across each dimension.

Descriptive analysis primarily examines the overall distribution of survey data, including means and standard deviations. This study employed a five-point Likert scale to calculate the mean and standard deviation for multiple dimensions of digital competency among Master of International Chinese Education students. Statistical results indicate that, except for “Digital Technical Skills”, the mean scores for all other dimensions of digital competency among Master’s students in International Chinese Education exceeded 3.50, with standard deviations above 0.8 and a maximum value of 5.00. This reflects that respondents generally rated their digital competency levels as “Fairly Adequate” or “Fairly Competent”. Therefore, it can be preliminarily concluded that the overall digital competency of Master’s students in International Chinese Education is at a moderate to above-moderate level.

The average scores for each dimension of digital competency among Master’s candidates in International Chinese Education, ranked from highest to lowest, are as follows: Digital Application > Digital Awareness and Ethics > Digital Technical Knowledge > Digital Professional Development > Digital Technical Skills. The Digital Application dimension recorded the highest average score of 3.73, indicating that participants possess strong practical abilities in leveraging digital platforms and technologies for teaching. The average score for the Digital Technical Skills dimension was the lowest at 3.49, showing a noticeable decline compared to other dimensions. This may be attributed to the fact that 69.08% of the participants were current Master’s degree candidates. They exhibited relatively lower proficiency in acquiring, managing, analyzing, and applying digital skills, lacked sufficient mastery, and had limited practical teaching experience. Consequently, they found it challenging to consolidate and enhance their digital technical skills through real-world application.

Analysis of Factors Influencing Digital Competence in International Chinese Education Master’s Programs

The preceding analysis examined whether demographic factors influence the digital literacy of international Master of Chinese Education students. Findings indicate that current academic/professional status, undergraduate major, institutional background, and internship experience all impact the development of digital literacy to varying degrees. While the effects of sample variability warrant attention, the common challenges encountered during the master’s training phase also merit exploration. Table 1 shows that the mean scores across the three dimensions range from 3.58 to 4.1. While the average values for social factors, institutional factors, and personal factors exhibit significant variation, the standard deviation does not exceed 0.1. This indicates a high degree of agreement among participants regarding the content of the influencing factors.

Table 1

Mean Scores of Dimensions Influencing Digital Competence Among International Master’s Students in Chinese Education

Name	Sample size	Minimum	Maximum	Mean	Standard deviation
Social factors	164	1.00	5.00	3.58	0.82
School factors	164	1.00	5.00	3.62	0.84
Personal factors	164	2.00	5.00	4.10	0.75

Social factors. Three items were designed in the questionnaire on social factors. A3 had a mean of 3.64 (the highest within the dimension) and a standard deviation of 0.83, indicating that most participants recognized the role of industry standards in promoting digital competency development. Although some differences existed between groups, the overall response was relatively stable. Item A2 had a mean of 3.49 (lowest within the dimension) and a standard deviation of 0.84 (highest within the dimension), indicating that the practical conversion of social funding support was low. Due to regional and institutional disparities in resource allocation, participants' recognition of funding support varied significantly. Item A1 had a mean of 3.62 and a standard deviation of 0.78, suggesting that participants' perception of policy implementation was at a moderately high level, with smaller intergroup differences compared to the funding dimension.

School factors. The school-related questionnaire included five items. B3 had the highest mean (3.72) and standard deviation (0.79) within the dimension. Subject competitions and professional internships were directly linked to skill enhancement, receiving high recognition from participants and showing relative stability across groups. Both B1 and B2 had means of 3.60, but B2's standard deviation (0.84) exceeded B1's (0.78), indicating more pronounced differences in perceptions of "curriculum comprehensiveness". B4 had the lowest mean (3.54) and highest standard deviation (0.90) within the dimension, reflecting uneven distribution of resources like microteaching classrooms across and within schools, leading to increased variation among participants. B5 had a mean of 3.66 and a standard deviation of 0.87, reflecting individual differences in instructors' technical focus (due to varying research directions and teaching styles).

Personal factors. Four items were designed in the personal factors questionnaire. C1 "Passion for Chinese language education and willingness to enhance digital literacy", C2 "School and teacher emphasis on promoting self-improvement", and C3 "Interest-driven proactive learning of digital technologies" all had mean scores between 4.07 and 4.08. C4 "Recognition of digital literacy's value for future Chinese teaching" had a mean of 4.18 (the highest within the dimension), with standard deviations ranging from 0.72 to 0.78 (indicating minimal group variation). This demonstrates that, at the individual level, Master's students in international Chinese education exhibit a highly positive attitude toward enhancing digital literacy: On one hand, the high mean and low variance of C4 highlight this group's strong consensus on "digital literacy empowering teaching". On the other hand, C1 (professional passion), C2 (external motivation), and C3 (interest-driven learning) collectively form a synergistic framework integrating internal and external drivers.

Conclusion

In summary: The average scores for each dimension of digital competency among Master's students in International Chinese Education, ranked from highest to lowest, are as follows: Digital Application > Digital Awareness and Ethics > Digital Technical Knowledge > Digital Professional Development > Digital Technical Skills. Social factors, institutional factors, and individual factors all influence the development of digital competency among these students, with individual factors having the greatest impact.

The guiding role of societal standards receives widespread recognition, yet funding gaps and policy implementation progress warrant attention. Together, these form the societal environmental factors influencing digital competency development. Future efforts should focus on refining policies and coordinating resources to sustain positive societal impacts. The promotional role of teaching practices at the institutional level in enhancing digital competence is highly acknowledged. However, differences in perceptions exist regarding curriculum

design, resource/equipment availability, and mentor guidance. Optimizing the curriculum system, coordinating resource allocation, and strengthening mentor support are needed to narrow individual gaps. Minimal differences among the surveyed groups indicate unified recognition and strong willingness toward digital competence development at the individual level, establishing a solid subjective foundation for improvement.

National policies and systems; institutional software and hardware support; and personal awareness and skills are universally acknowledged by the surveyed group as the most influential factors in enhancing the digital literacy of graduate students in international Chinese education.

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