Systemic Barriers and Adaptive Challenges to the Employability of International Chinese Language Education Graduates in the Era of Artificial Intelligence

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Abstract

As artificial intelligence (AI) reshapes the global education ecosystem, graduates of International Chinese Language Education (ICLE) programs face dual structural pressures from technological disruption and shifting labor market demands. This study aims to explore the technological dilemmas and educational challenges hindering the enhancement of employment competitiveness among graduates of ICLE in the AI era. Through semi-structured interviews with 30 participants (20 ICLE graduates, 5 university career counselors, and 5 HR professionals), data analysis was conducted using open coding, axial coding, and selective coding. Three major structural barriers were identified: curriculum disconnect from AI, fragmented acquisition of digital skills, and insufficient institutional and faculty support for AI integration. These severely constrain ICLE graduates' employment readiness in AI-mediated environments. This study enriches theoretical understanding of how information technology reshapes disciplinary employability, providing targeted guidance for ICLE curriculum reform, institutional innovation, and skill development.

Keywords: employment competitiveness, artificial intelligence, international Chinese language education

1. Introduction

As emerging technologies like AI accelerate integration into society, traditional jobs and employment structures are profoundly transformed, leaving graduates (especially those in humanities such as International Chinese Language Education) facing greater employment challenges amid intensified competition. Enhancing employment competitiveness has become an urgent task for higher education—it not only helps graduates build adaptability and job transition capabilities for uncertain environments (Sohaee et al., 2024) but also bridges the gap between talent cultivation and societal needs, driving high-quality educational transformation (Khattri et al., 2023).

International Chinese Language Education (ICLE) is a key pillar for national language and cultural dissemination and international exchange, with growing strategic significance amid globalization (e.g., the advancing Belt and Road Initiative and rising global demand for Mandarin). However, ICLE graduates face significant employment pressure: AI disrupts traditional language-teaching roles (Guo et al., 2025), and curricula are misaligned with the needs of the global education market (Díaz et al., 2022). Post-pandemic, complex international environments worsen prospects, making it an urgent challenge for ICLE to enhance graduates' employment competitiveness amid new technologies and demands.

The AI era reshapes the global education ecosystem and talent demand, exerting dual impacts on ICLE graduates' employment competitiveness. AI empowers them in language teaching, assessment, and cross-cultural communication to expand career paths (Gou, 2025), but also creates shortcomings in their technological adaptability, digital literacy, and job suitability (Pandit et al., 2025). Existing research focuses on AI's effectiveness in teaching/assessment (Cao et al., 2020) and teacher strategy innovations (Lin, 2022), with few exploring systemic obstacles to the cultivation of ICLE graduates' employment competitiveness. While some studies examine curriculum-intelligence integration (Zhou, 2023) or single-skill training (Maity, 2019), key challenges such as lagging course design and insufficient AI integration mechanisms are rarely examined from an overall educational ecosystem perspective.

In view of this, this paper uses a qualitative research approach to explore the technical difficulties and educational challenges that hinder the improvement of ICLE graduates' employment competitiveness in the era of artificial intelligence.

The remainder of this paper is organized as follows. Part Two reviews relevant literature, focusing on the development of ICLE graduates in the context of artificial intelligence and its impact on enhancing employment competitiveness. Part Three outlines the research methods, including qualitative methods, sampling strategies, data collection, and analysis procedures. Part Four presents the research findings based on thematic analysis of the interview data. Part Five conducts a comprehensive discussion of the results in conjunction with the existing literature, explores their theoretical and practical implications, and summarizes the study's limitations and recommendations for future research.

2. Literature Review

2.1 Theoretical Foundation

In the context of the AI era, research on the identification of barriers to employment competitiveness for graduates of the International Chinese Language Education (ICLE) program typically draws on four core theoretical frameworks. Competency-based education theory is used to analyze its practical application, emphasizing the alignment of current educational objectives with actual occupational demands, and focusing on cultivating graduates' competencies to align with workplace requirements (Açıkgöz & Babadoğan, 2021); Technology Determinism Theory examines how AI influences the structure, implementation, and outcomes of educational training programs, aiming to transform teaching methods and learning processes (Nguyen et al., 2023); Innovation Diffusion Theory focuses on the adoption and acceptance of AI technology within educational institutions and vocational training organizations (Héder, 2021); and Social-Technical Systems Theory explores the interactive relationships between AI and relevant stakeholders in training and education processes, such as how AI applications impact work environments, teacher-student interactions, and the overall effectiveness of programs (Rogers et al., 2019).

Competency-Based Education (CBE) theory centers on designing educational processes around “competency mastery” to precisely align with workplace demands (Açıkgöz & Babadoğan, 2021), while Innovation Diffusion Theory (IDT) focuses on the acceptance, dissemination patterns, and key influencing factors of new technologies in specific fields (Rogers et al., 2019). Applying CBE to this study can assess the extent to which ICLE professional courses are designed around the core competencies required for international Chinese language teaching in the AI era (such as AI-assisted teaching capabilities and cross-cultural communication skills), thereby evaluating their support for graduates' employment competitiveness; IDT can be used to investigate the prevalence of AI technology in the ICLE program and whether graduates' mastery of AI teaching tools constitutes a key factor influencing their employment competitiveness. Additionally, IDT can identify factors affecting the diffusion of AI technology in the ICLE field (such as technological applicability and the rationality of course design), thereby clarifying the role of graduates' technological adaptability in employment.

2.2 Related Concepts

Employment competitiveness encompasses a comprehensive system of knowledge, skills, and personal traits that enable individuals to obtain, maintain, and enhance their employment status in a dynamic labor market. Recent research indicates that employment capability is primarily dependent on cognitive abilities (such as self-reflection and problem-solving), which help graduates navigate nonlinear career development amid organizational restructuring (Koseda et al., 2024). As globalization deepens and the boundaries between domestic and international labor markets blur, higher education institutions are increasingly required to cultivate professional skills while fostering a global mindset. Empirical research indicates that graduates with higher digital literacy, interpersonal networking skills, and cross-cultural adaptability are more likely to secure employment quickly and demonstrate higher job retention rates (Thelma et al., 2024).

International Chinese Language Education (ICLE) has evolved into a strategic field for promoting language proficiency and cultural literacy, with its influence extending beyond China's borders. Building on China's global expansion of economic and geopolitical influence over the past two decades, ICLE initiatives (such as Confucius Institutes and university exchanges) have expanded to 160 countries (Jia et al., 2024). These initiatives not only address the growing demand for Chinese language instruction but also serve as channels for cultural diplomacy, showcasing Chinese literature, art, and social practices through extracurricular activities. By combining language instruction with experiential learning, ICLE aims to cultivate language proficiency and critical cultural awareness

(Wu, 2023). The strategic importance of ICLE calls for the establishment of a more refined and comprehensive innovative teaching framework to cultivate scholars with both language communication and cultural dissemination capabilities, thereby promoting globalization. However, under the dual pressures of global competition and changing occupational demands, ICLE graduates face significant employment pressures. On the one hand, AI language platforms, such as innovative translation tools, have diverted demand for basic Chinese language instruction (Tian, 2024). On the other hand, the ICLE curriculum system is out of sync with global practical needs and lacks sufficient training in market-oriented skills. Therefore, enhancing the employment competitiveness of ICLE graduates has become a critical issue.

In the AI era, ICLE graduates are facing a profound transformation of their professional capabilities and career paths. AI-driven language-learning applications, intelligent assessment systems, and automated translation tools have significantly enhanced the technical capabilities of language educators, enabling them to adopt more personalized, data-driven teaching methods and adaptive learning experiences (Zhao, 2025). At the same time, these technologies impose new demands on graduates, who must possess advanced digital literacy to design AI-integrated curricula, interpret learning analytics data, and navigate emerging teaching platforms (Kambhampati & Patel, 2025). Empirical research indicates that ICLE graduates proficient in AI-supported tools exhibit higher confidence in their adaptability in the job market and report smoother career transitions (Kabanda, 2025). However, the rapid pace of AI innovation often outpaces the speed of curriculum reform, leaving many ICLE programs structurally unable to systematically embed AI competencies (George, 2023). This mismatch not only creates skill gaps but also exacerbates graduates' anxiety about their careers in an increasingly technology-mediated educational environment (Al Shuaili, 2025). Therefore, while AI offers substantial opportunities to enhance employability, it also highlights the urgent need for targeted instructional design reforms, robust teacher development, and strategic skill-building pathways.

Although artificial intelligence has gained increasing recognition as a key driver of teaching innovation and enhanced employability, existing research predominantly focuses on AI's enabling role in teaching applications (Zhao, 2025), with limited exploration of how AI reshapes the employment competitiveness of ICLE graduates. Specifically, systematic and in-depth research remains lacking on the mechanisms by which AI technology impacts ICLE graduates' employability, technical challenges, and curricular barriers. Existing research has insufficiently addressed how AI technology can be embedded within the ICLE educational system and how it affects graduates' adaptability to future labour markets, leaving gaps in the in-depth analysis of AI technological challenges and curricular obstacles. To fill this gap, this study employs qualitative methods to explore the structural and educational barriers hindering ICLE graduates from enhancing their employability in the AI era.

3. Method

3.1 Data Collection

Following Boddy (2016) recommendation of 20–30 cases for qualitative studies, this study collected interview data from 30 participants: 20 ICLE graduates (A1–A20), five university employment staff (B1–B5), and five HR professionals (C1–C5), offering perspectives from students, institutions, and employers, as shown in Table 1.

Table 1. Coding and Identity Classification of Qualitative Interview Participants

Code	Identity	Affiliation Type	Role in Study
A1–A20	ICLE Graduates	Various universities (undergraduate, master's, PhD)	Provide firsthand insights into AI and employability
B1–B5	Employment Office Staff	Top ICLE universities in mainland China	Represent institutional employment perspectives
C1–C5	HR Professionals	ICLE-related enterprises and education organizations	Offer employer perspectives on AI-related competencies

To ensure the diversity and relevance of perspectives, a combination of purposive sampling and snowball sampling strategies was employed. Participants were initially selected based on their direct involvement with ICLE programs or graduate hiring processes, with specific attention to variation in academic level (undergraduate, master's, PhD), institutional affiliation, and professional role. Graduates were recruited from universities with active ICLE programs, while employment staff and HR professionals were identified through institutional contacts and alumni referrals. Snowball sampling was used to expand access to additional participants who met the inclusion criteria, particularly

through professional networks related in international Chinese language education. This approach allowed for the collection of rich, experience-based data across stakeholder groups.

Data were collected through semi-structured interviews in Mandarin, conducted either in person or via secure video conferencing. Each session lasted 45–60 minutes and was audio-recorded with consent. The detailed interview questions are provided in the Appendix A.

The interviews were conducted between January and March 2025, in both face-to-face and virtual formats to accommodate participants' availability. All procedures in this study followed established ethical standards for qualitative research. Participants were fully informed of the study's aims, methods, and potential implications before data collection. Written or verbal consent was obtained prior to the interviews, and participants were assured of anonymity and confidentiality through the use of pseudonyms and secure data storage. The study design, data handling, and reporting adhered to principles of voluntary participation, non-maleficence, and academic integrity, ensuring respect for participants' rights and minimizing potential risks. All interviews were recorded and transcribed verbatim with prior consent. The resulting corpus comprises 30 interview transcripts, totaling approximately 128,576 Chinese characters, equivalent to 102,000 English words, and spans over 215 single-spaced transcript pages.

3.2 Data Analysis

To extract meaningful patterns from the interview corpus, lexical preprocessing was first performed using Jieba segmentation in Python 3.8 to remove noise and standardize the text. A three-phase qualitative coding strategy was then applied—beginning with initial concept identification, followed by thematic clustering, and culminating in the synthesis of core categories representing systemic and educational barriers to employability. NVivo software was used for data organization, memo writing, and iterative comparison to ensure coding consistency. To enhance credibility and trustworthiness, member checking was conducted with selected participants, and an audit trail, peer debriefing, and reflexive journaling were maintained throughout the analytic process.

4. Analysis and Results

4.1 Keyword Extraction Analysis

Table 2. Key High Frequency Word List

Rank	Keyword	Frequency
1	employment competitiveness	88
2	artificial intelligence	81
3	curriculum integration	77
4	AI tools	74
5	teaching methods	71
6	skill acquisition	69
7	digital literacy	64
8	adaptability	60
9	technology acceptance	57
10	practical training	55
11	online platforms	52
12	job market	50
13	self-learning	47
14	feedback systems	44
15	educational reform	42
16	teaching resources	40
17	graduate readiness	38
18	student engagement	35
19	industry demand	32
20	innovation in pedagogy	30

To support subsequent coding and theory development, an initial lexical analysis was conducted using Jieba segmentation within the Python 3.8 environment. This step tokenized the textual corpus and removed non-informative elements such as punctuation, common stop words, irrelevant vocabulary, and redundant expressions. The cleaned data were subjected to word-frequency analysis to identify semantically relevant, high-frequency keywords that reflect the thematic focus of the interviews.

From this process, 20 representative keywords were extracted, encompassing concepts related to AI technology, digital pedagogy, curriculum design, self-directed learning, and job market alignment (Table 2). These keywords serve as the lexical foundation for open coding and thematic abstraction in later stages of analysis. They not only reflect the concerns of graduates, administrators, and employers but also provide insights into the discourse structure surrounding employment competitiveness in ICLE programs.

Figure 1. Key High Frequency Words Cloud Map

Figure 1 highlights the dominant themes in the qualitative interview data in this study, with terms such as teaching, employment, competitiveness, artificial intelligence, and curriculum emerging most prominently. These keywords reflect the core concerns of ICLE regarding how AI integration influences pedagogical practices, skill acquisition, and employability. The frequency and centrality of terms such as methods, tools, integration, and adaptability further underscore the importance of technological proficiency and curriculum alignment in enhancing employment competitiveness in the AI-driven education sector.

4.2 Coding Process of the Study

4.2.1 Open coding

The initial stage of analysis involved examining interview data line by line to extract recurring ideas and conceptually group them into categories (Glaser, 2016). Each line of the transcribed texts was carefully reviewed to identify core semantic units that captured participants' direct experiences, perceptions, and evaluations related to AI integration, curriculum design, teaching practice, and career development (Qiao et al., 2025). Table 3 illustrates the key experiential categories that affect ICLE graduates' employment competitiveness in the AI era.

Table 3. Examples of Open Coding

Conceptual Code	Emergent Category	Original Transcript (with Participant ID)
Platform complexity causes hesitation	Technological Anxiety	"I feel nervous about using these AI tools—some platforms are just too complicated to navigate." (A6)
Resistance from traditional faculty	Technological Anxiety	"Most of our senior teachers still avoid using AI applications. They think it's unreliable." (B3)
Disconnect between taught content and tools	Curriculum-Tool Misalignment	"What we learned in class had nothing to do with the tools required in real-world classrooms." (A9)
Enterprise tool threshold for hiring	Curriculum-Tool Misalignment	"At our company, candidates who don't know Lingvist or Quizlet don't even make it to the second round." (C2)
Learning AI via self-initiated channels	Self-Driven Digital Learning	"I had to figure it all out by myself by watching Bilibili tutorials—there was no official training." (A11)
Informal tech learning is the norm	Self-Driven Digital Learning	"Our students explore AI tools mostly on their own—we don't have structured sessions for that." (B2)
Lack of awareness of industry expectations	Employment Information Gap	"We're not even aware of what AI tools employers expect us to master." (A5)
Outdated career guidance	Employment Information Gap	"Our career center rarely updates us on jobs that require AI skills." (B1)
Unequal access to AI learning opportunities	Disparity in Digital Literacy	"Some undergrads already had AI training, while I only started learning it during my Master's." (A15)
Program disparity affects tool mastery	Disparity in Digital Literacy	"Students from linguistics have more AI exposure. In education tracks, it's still very low." (B4)
Insufficient simulation opportunities	Lack of Practical AI Training	"There's only one speech lab on campus and too many students—it's hard to get practice time." (A17)
Absence of integrated AI modules	Lack of Practical AI Training	"We don't get to work on AI-assisted projects during coursework." (C5)
Cost barriers to tool integration	Institutional Implementation Barriers	"Some platforms charge high license fees, so our department avoids using them." (B5)
Language interface issues in tools	Institutional Implementation Barriers	"Many AI platforms are in English, which puts off a lot of local students at the start." (A8)
Reimagining future professional identity	Professional Identity Shift	"I don't just want to teach language—I want to train people in intercultural AI communication." (A12)
AI skills redefine hiring expectations	Professional Identity Shift	"We look for people who can build and run their own online curriculum—not just traditional teachers." (C4)

4.2.2 Axial Coding

The intermediate stage of analysis involved organizing conceptually related codes into higher-order categories to uncover underlying patterns and logical connections (Lian et al., 2025). Building on the initial coding results, the study refined core concepts into abstract themes that illustrate how technical dilemmas and educational challenges impact the employment competitiveness of ICLE graduates in the AI era (Jiang et al., 2024). Through iterative comparison and clustering, three dimensions emerged—Systemic Constraints, Adaptive Responses, and Professional Transition—reflecting the interaction of institutional structures, personal initiative, and labor market demands. Five key themes were identified (Table 4): Curricular Discontinuity, Technology-Institution Disjunction, Fragmented Skill Development, Pragmatic Career Anxiety, and Emergent Digital Adaptability. Together, they capture the multi-actor dynamics shaping graduates' competitiveness in AI-enhanced contexts.

Table 4. Main Categories Derived from Axial Coding

Main Category	Sub-category	Content of Category
Curricular Discontinuity	Course–Industry Mismatch	Curriculum content was widely viewed as outdated, lacking alignment with AI literacy and job market standards.
	Theoretical Overload	Respondents noted that theory-heavy courses failed to equip graduates with applicable technological competencies.
Technology-Institution Disjunction	Faculty Tech Proficiency Gap	Many instructors lacked familiarity with AI tools, leading to missed opportunities for modeling digital teaching.
	Resource Integration Lag	Institutions showed delays in incorporating AI infrastructure into mainstream teaching environments.
Fragmented Skill Development	Informal Learning Reliance	Graduates frequently reported turning to external sources (e.g., YouTube, forums) for AI-related learning.
	Internships as Learning Catalysts	Internship experiences were often the only structured contexts in which students could apply AI tools practically.
Pragmatic Career Anxiety	Confidence Gap	Students and graduates expressed concern over how to communicate AI skills effectively in job applications.
	Evaluation and Feedback Insecurity	Ambiguity around how AI-enhanced abilities would be assessed by employers contributed to uncertainty.
Emergent Digital Adaptability	Self-Initiated Competence Building	Respondents showed high motivation to independently master tools like chatbots, automated correction apps, etc.
	Evolving Professional Identity	Some graduates began shifting career aspirations toward EdTech roles, digital curriculum design, or consultancy.

4.2.3 Selective Coding

Table 5. Selective Coding Results

Core Category	Nature of Challenge	Description
Systemic Curriculum–AI Disalignment	Educational Challenge	Reflects the misalignment between formal curricula and the technological demands of the labor market. Graduates, employment staff, and HR personnel commonly identified outdated instructional models, a lack of AI-enhanced teaching content, and insufficient digital assessment as barriers to readiness.
Fragmented Digital Skill Trajectories	Technical Dilemma	Indicates the inconsistent, informal, and self-directed nature of AI skill acquisition. Due to limited institutional support, learners resorted to personal exploration or internships to build digital literacy, resulting in unequal access to job-relevant competencies and feelings of inadequacy or uncertainty.
Strategic Professional Repositioning	Adaptive Response and Outcome	Describes the ways in which graduates recalibrated their career goals and professional identities in response to AI disruptions. Many shifted toward roles that emphasize tech fluency (e.g., EdTech trainers, curriculum consultants), underscoring the emergence of AI as a career differentiator and coping mechanism.

The selective coding phase constructs a high-level theoretical narrative that synthesizes categories and themes from open and axial coding (Sui et al., 2025). Guided by the objective of examining the technical dilemmas and educational challenges that constrain ICLE graduates' employment competitiveness in the AI era, three overarching categories were distilled: Systemic Curriculum–AI Misalignment, Fragmented Digital Skill Trajectories, and Strategic Professional Repositioning. These categories collectively illustrate how institutional structures, technological conditions, and individual strategies interact to constrain and reshape graduates' readiness for

AI-mediated professional environments. Within them, multiple specific barriers emerge—for example, the misalignment of curricula with technological demands, the uneven and informalized pathways of digital skill acquisition, the lack of institutional and faculty capacity for AI integration, uncertainty in career positioning, and the absence of mechanisms to formally recognize AI competencies. Together, these interrelated barriers demonstrate that employability is not determined by individual effort alone but is co-constructed through the interplay of systemic shortcomings and adaptive responses within a rapidly evolving technological landscape.

4.3 Theoretical Saturation Testing

Theoretical saturation is the point at which no new categories or meaningful relationships emerge from further data analysis, indicating conceptual completeness (Moura et al., 2021). To assess saturation, all 30 interview transcripts—including 20 ICLE graduates, 5 employment staff, and 5 HR professionals—were re-examined using the whole coding process. The core categories—Systemic Curriculum–AI Disalignment, Fragmented Digital Skill Trajectories, and Strategic Professional Repositioning—consistently captured recurring patterns across groups. Although terms such as platform instability and AI policy ambiguity emerged, they reinforced existing categories rather than creating new ones. Thus, the coding framework is saturated, and the theoretical model demonstrates stability, coherence, and explanatory power in explaining the educational and technical barriers shaping ICLE graduates' employment competitiveness in the AI era.

4.4 Theoretical Construction

Theoretical construction in this study builds directly upon the multi-stage coding process, ensuring coherence between empirical data and conceptual abstraction. Open coding revealed recurring issues, including outdated curricula, reliance on informal skill development, and limited institutional support. Axial coding then organized these into broader categories reflecting systemic, technical, and institutional dynamics. Through selective coding, these patterns were distilled into three core domains—educational misalignment, technical fragmentation, and institutional-resource limitations—that serve as the structural foundations shaping ICLE graduates' employment competitiveness in the AI era. The following three themes represent the concrete manifestations of these higher-order categories, demonstrating how systemic barriers translate into graduates' reduced readiness for AI-mediated professional contexts.

4.4.1 Curriculum-AI Misalignment Restricts Professional Readiness

The coding results indicate that a key educational challenge is the disconnect between ICLE curricula and the demands of an AI-driven job market. Participant narratives across all groups revealed that programs still emphasize traditional pedagogy, with limited integration of digital tools or AI-supported methods, restricting students' ability to apply knowledge in technology-rich teaching contexts (Zhang, 2022). Graduates reported little structured training in AI applications such as intelligent assessment or adaptive learning systems. At the same time, employment officers noted that outdated syllabi and conservative teaching models prevent alignment with digital literacy benchmarks. This lack of a responsive curriculum framework undermines graduate preparedness and weakens employment competitiveness in an increasingly technological workforce (Lukashe et al., 2024).

4.4.2 Fragmented Skill Acquisition and the Informalization of AI Learning

A key technical dilemma identified is the fragmented and informal nature of digital skill development among ICLE graduates. Instead of structured university modules, participants relied on self-learning, internships, or peer support. While reflecting student initiative, this underscores institutional failure to systematize digital transformation. The lack of standardized pathways leads to uneven outcomes and complicates employers' evaluation of competencies (Hamori, 2023). HR representatives noted that although applicants listed AI tools on résumés, few showed functional mastery. Without embedded digital literacy frameworks and experiential opportunities, institutions shift critical preparation to students, reproducing inequities and inefficiencies in the employment pipeline (Strielkowski et al., 2025).

4.4.3 Lack of Institutional and Faculty Support Systems for AI Integration

The final barrier relates to institutional and faculty limitations in embedding AI into ICLE education. Interviews consistently highlighted faculty resistance, lack of professional training, and inadequate access to AI-based tools. Both students and teachers often reported unfamiliarity with platforms introduced for blended or online teaching, resulting in underutilization (A. S. George, 2023). This reflects broader inertia, in which technological investments are not matched by pedagogical reform or policy support, leaving AI peripheral rather than central to instructional practice. Consequently, graduates are compelled to depend on external resources to develop essential digital skills, fragmenting their preparation and diminishing competitiveness in AI-mediated professional roles (Mission et al.,

2024).

Figure 2 conceptualizes the multidimensional barriers shaping the employment competitiveness of ICLE graduates in the age of artificial intelligence. The model identifies three domains of structural barriers—educational challenges, technical dilemmas, and institutional-resource limitations—which manifest as curriculum–AI misalignment, fragmented digital skill acquisition, and insufficient institutional and faculty support. These manifestations collectively lead to unprepared graduates and weakened labor-market performance, and they demonstrate how systemic constraints outweigh individual agency in shaping employability outcomes.

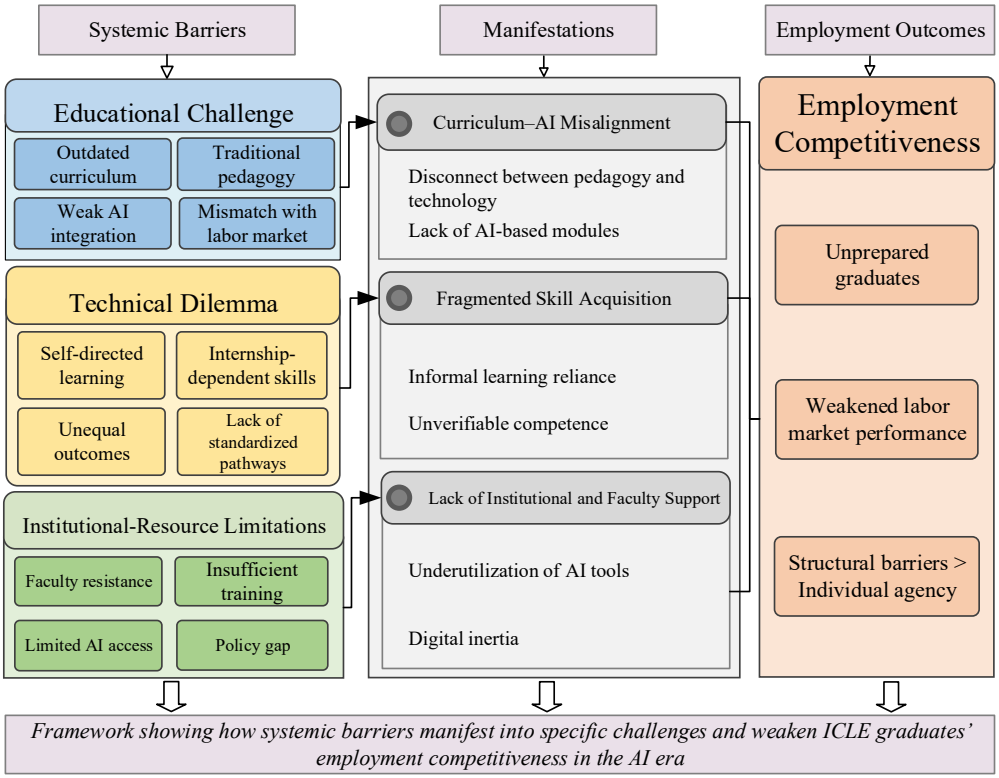

Figure 2. Framework of Barriers and Response Mechanisms Shaping ICLE Graduates' Employment Competitiveness in the AI Era

5. Discussion

This study explores the technical dilemmas and educational challenges that hinder ICLE graduates' employment competitiveness in the AI era, focusing on gaps in curriculum design, skill development, and AI integration. Drawing on semi-structured interviews with 30 stakeholders—including graduates, faculty, and employment officers—the analysis identified three systemic barriers: curriculum–AI misalignment, fragmented digital skill acquisition, and insufficient institutional and faculty support. These findings reaffirm existing concerns about curricular rigidity and institutional inertia (B. George & Wooden, 2023; Shi, 2024), but extend them through participant-driven narratives across diverse stakeholder groups, highlighting how fragmented infrastructure, absent skill pathways, and limited career planning erode competitiveness in AI-mediated labor markets.

First, curriculum–AI misalignment emerged as a significant educational barrier. ICLE programs remain rooted in traditional pedagogy, with limited adaptation to technological developments (Tello, 2024). As one graduate noted, "What we learned in class had nothing to do with the tools required in real-world classrooms" (A9). Similarly, an HR participant emphasized, "At our company, candidates who don't know Lingvist or Quizlet don't even make it to the second round" (C2). These accounts illustrate how outdated curricula reduce graduates' readiness for digital environments, echoing Lukashe et al. (2024), who argue that curriculum stagnation impedes alignment with global digital competencies.

Second, fragmented digital skill acquisition and reliance on informal learning pathways present a core technical dilemma. Many participants reported gaining AI-related skills through self-study, internships, or peer learning rather

than structured university training. A graduate explained, "I had to figure it all out by myself by watching Bilibili tutorials—there was no official training" (A11). Employment officers also acknowledged this issue, stating, "Our students explore AI tools mostly on their own—we don't have structured sessions for that" (B2). While such self-directed learning shows initiative, it reinforces inequities in access and weakens employer confidence in graduates' qualifications (Hamori, 2023; Strielkowski et al., 2025).

Third, institutional and faculty-level constraints continue to limit the integration of AI into ICLE education. Despite policy rhetoric on digital transformation, participants highlighted insufficient faculty training, inadequate infrastructure, and conservative teaching practices as key obstacles. For example, one employment officer admitted, "Some platforms charge high license fees, so our department avoids using them" (B5). At the same time, a graduate added, "Many AI platforms are in English, which puts off a lot of local students at the start" (A8). These narratives reinforce the broader pattern of digital inertia in higher education, where technological investments are rarely matched by capacity building or pedagogical reform (B. George & Wooden, 2023). Graduates' experiences with such underprepared systems underscore the urgent need for stronger institutional readiness and faculty development to sustain AI adoption across the curriculum and practice.

5.1 Theoretical Implication

Compared with existing research, this paper contributes to the discourse on graduate competitiveness in International Chinese Language Education (ICLE) within the context of artificial intelligence. Prior studies on educational technology and employability have mainly focused on instructional tools and teaching strategies (Akintayo et al., 2024), as well as general competencies such as language proficiency (Abraham et al., 2022) and intercultural communication (Chen & Mei, 2024). However, recent scholarship increasingly highlights how AI reshapes skill requirements and pedagogical structures in language education. For instance, AI-supported adaptive platforms can enhance learner autonomy but may also exacerbate inequities when institutional support is lacking (Nopas, 2025). Moreover, employability is now seen as dependent on hybrid competencies that integrate digital literacy with intercultural skills (Satar et al., 2024). Similarly, Rajabi (2025) demonstrates that graduates proficient in AI-mediated teaching tools achieve smoother labor market transitions, underscoring the urgent need to align curricula with technological advancements.

Second, this study broadens the theoretical scope of research on International Chinese Language Education (ICLE). Prior work has chiefly examined AI's impact on pedagogy, textbook design, and teacher development (Kim, 2024), with little attention to how students navigate career uncertainty and competitive pressure amid technological change (Almuhanna, 2025). By focusing on ICLE graduates, career counselors, and HR professionals, this study illustrates how individuals cognitively adapt and reconstruct professional trajectories in AI-mediated contexts. It demonstrates that employability is embedded in the interaction between systemic constraints and adaptive strategies, offering a nuanced framework for understanding professional identity formation in digitalized environments.

Third, while Human Capital Theory (Wuttaphan, 2017) highlights the value of educational investment for labor market adaptability, and Constructivist Learning Theory (Bada & Olusegun, 2015) underscores learner agency in socially and technologically mediated contexts, competency-based education (CBE) offers a more practice-oriented framework by directly aligning educational processes with occupational demands (Açıkgöz & Babadoğan, 2021). This study builds on and deepens CBE by showing that in the AI era, employability requires not only measurable skills, but the integration of dynamic digital competencies—such as AI tool literacy, instructional design for online platforms, and adaptive communication. These findings suggest that traditional CBE models must evolve to address fragmented digital learning and misaligned curricula by embedding technology-responsive competencies and developing scalable mechanisms to assess them. Thus, the study not only applies CBE but also contributes to its refinement in the context of intelligent, evolving education systems.

From a methodological standpoint, the study also contributes to theory-building by integrating grounded qualitative coding with structural equation modeling, offering a rare mixed-methods blueprint for tracing perceptual antecedents to labor outcomes. This design overcomes the limitations of many Technology Acceptance Model (TAM)-based studies that rely solely on behavioral intention and neglect downstream effects (Preacher & Hayes, 2008). Theoretical claims are thus not merely inferred but empirically demonstrated across diverse institutional tiers and stakeholder groups, enhancing both internal validity and generalizability.

Finally, this study proposes a conceptual model to integrate these insights: ICLE employability is shaped by the triadic interaction of curriculum alignment, digital skill pathways, and institutional-resource readiness, moderated by individual adaptive strategies and credentialing mechanisms. This model advances theoretical understanding by shifting the analysis from isolated factors to a systemic framework, highlighting how structural and individual

dynamics jointly determine graduate competitiveness in AI-driven educational landscapes.

5.2 Practical Implication

Building on the three core findings of this study, targeted recommendations are proposed across individual, institutional, and employer levels to address the specific barriers identified.

At the graduate level, ICLE students should be systematically trained to move beyond passive learning and engage in proactive digital upskilling. Institutions could integrate mandatory AI literacy modules into degree programs, focusing on practical tools such as automated assessment systems, adaptive learning platforms, and AI-based classroom management applications. In addition, establishing AI teaching portfolios would enable students to demonstrate their applied competencies to future employers.

At the institutional level, universities offering ICLE programs should establish a digital competency framework that links curricular outcomes with market-driven technological skills. This could involve embedding AI-enabled tasks into core language pedagogy courses, offering micro-credential programs or certifications in EdTech applications, and allocating funds to support faculty training workshops on AI integration in instruction and assessment. Furthermore, universities should partner with education technology companies to co-develop practicum-based learning environments that simulate real-world teaching scenarios enhanced by AI.

At the employer level, organizations engaged in international language education should explicitly update hiring standards to reflect the demand for AI-supported instructional capabilities. Employers can co-design AI-centered internship programs with universities, provide feedback on skill gaps observed in recent graduates, and invest in onboarding training modules for entry-level employees to ease their transition into technology-enhanced work environments. Such collaboration would align industry needs with academic preparation and foster a more seamless transition from graduate to workforce.

5.3 Research Limitations and Future Prospects

This study examines the employment competitiveness of International Chinese Language Education (ICLE) graduates in the context of artificial intelligence, but several limitations remain. First, the sample was primarily drawn from mainland China. Despite purposive and snowball sampling to include graduates, career service staff, and HR personnel, the regional and institutional diversity was limited, constraining generalizability across transnational or distinct contexts. Second, the study relied exclusively on a qualitative approach, using semi-structured interviews. While this design provided rich insights into stakeholder perceptions and experiences, it does not capture generalizable patterns or establish causal relationships. Future research should adopt mixed-methods or experimental designs to trace better the dynamic relationship between AI implementation and graduate career development. Expanding sample diversity and methodological strategies would deepen understanding of employability in the AI era and provide more forward-looking implications for talent cultivation and education policy. Finally, future research could incorporate Innovation Diffusion Theory (Rogers, 2019) to complement quantitative perspectives by examining the adoption, dissemination, and normalization of AI technologies within educational institutions. This framework would illuminate the organizational and cultural factors influencing technology diffusion, thereby offering a more systematic account of how competency development and technological adoption interact to shape employment competitiveness.

6. Conclusions

This study investigates the employment competitiveness of International Chinese Language Education (ICLE) graduates in the context of artificial intelligence. Based on semi-structured interviews and a multi-phase qualitative coding process, it identifies three structural barriers that systematically constrain graduate readiness for AI-mediated environments: curriculum–AI misalignment, fragmented and informal skill acquisition, and insufficient institutional and faculty support. These barriers highlight that employability challenges are not solely individual but embedded within systemic and institutional contexts, where outdated curricula, informalized digital learning, and weak resource integration collectively undermine competitiveness. At the same time, graduates' motivation to adapt through self-directed exploration underscores the dual role of structural constraints and individual agency in shaping career trajectories. By linking educational practices, technological infrastructures, and labor market demands, the study advances understanding of how AI reshapes employability formation in language education. It emphasizes the need for coherent reforms in curriculum design, digital skills development pathways, and institutional readiness, thereby providing both theoretical insights and practical guidance to strengthen ICLE graduates' competitiveness in increasingly AI-driven professional landscapes.

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Appendix A

Table A1. Interviewee Related Questions

Number	Interview Questions
Q1	"In your opinion, what technological challenges have you encountered during your education in ICLE that hindered your career readiness?"
Q2	"Can you describe any difficulties you faced with the integration of AI technologies into your curriculum, and how did these affect your learning outcomes?"
Q3	"Do you believe that there were any gaps in the curriculum of your program that hindered your ability to acquire skills necessary for the modern job market?"
Q4	"How well do you think the education you received prepared you to use AI-driven tools effectively in your professional career?"
Q5	"What skills do you feel were underdeveloped or insufficiently addressed during your education, particularly in relation to AI and technology integration?"
Q6	"In what ways do you think the use of AI tools in your education could have been improved to better enhance your job readiness and competitiveness?"
Q7	"How do you feel about the alignment of your education with current industry demands, especially regarding AI and technology-driven work environments?"
Q8	"Do you think the curriculum sufficiently addressed the use of technology in the teaching of Chinese to international students? If not, what aspects could be improved?"
Q9	"What are the specific educational challenges you faced in adapting to technological tools and AI-based learning platforms during your studies?"
Q10	"How do you believe AI integration could be better leveraged in your education to improve skill development and overall employability?"
Q11	"Were there any gaps in technology integration within your education program that impacted your ability to compete in the job market for ICLE?"
Q12	"How do you view the impact of technological and AI challenges on your readiness for work in an AI-driven job market?"
Q13	"What improvements do you think could be made to curriculum design or technology integration to better prepare graduates for employment in the field of ICLE?"
Q14	"In your opinion, what role do educational institutions play in addressing the technological challenges that hinder graduates' competitiveness in the global job market?"
Q15	"How do you perceive the gap between the skills you acquired during your education and the skills required by employers in the AI-driven job market?"

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Author contributions

M.L. and C.K. contributed to the conceptualization of the study. M.L. and W.P. designed the methodology. W.P. conducted the data collection. M.L. performed the formal analysis and drafted the original manuscript. C.K. and W.P. contributed to the review and editing of the manuscript. C.K. supervised the project and oversaw the overall research process. All authors have read and approved the final version of the manuscript.

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Data availability

The datasets generated and/or analyzed during the current study are not publicly available due to privacy restrictions but are available from the corresponding author on reasonable request.

Ethics approval

This study was reviewed and approved by the Research Ethics Committee of Mahachulalongkornrajavidyalaya University (Certification No. R. 298 / 2025; Ref. MCU 8007/R.298), dated May 30, 2025.

Consent to participate

Informed consent was obtained from all participants prior to data collection. Participation was voluntary and participants had the right to withdraw at any time.

Consent for publication

All participants consented to the anonymous publication of findings derived from their responses.

Competing interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.