

Bridging The Skills Gap: How Assessment Design, Industry Engagement, and Institutional Support Predict Employability Skills in Chinese Vocational Education

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Abstract

This study investigated employability skills gaps between China's 1+X HR certificate graduates and employer expectations in Guangdong Province and identified factors predicting skills development. A convergent parallel mixed-methods design integrated quantitative surveys ($n = 800$: 400 graduates, 400 employers) with qualitative interviews ($n = 15$: graduates, employers, faculty). Independent samples t-tests compared graduate capabilities with employer expectations across nine competency dimensions. Confirmatory factor analysis validated measurement models, while structural equation modeling tested relationships between four predictors (self-efficacy, institutional support, industry engagement, and curriculum alignment) and employability skills. Thematic analysis of interviews explained quantitative patterns, with findings integrated through joint display matrices. All nine employability dimensions showed statistically significant gaps ($p < .001$) with large-to-very-large effect sizes (Cohen's $d > 0.87$). Professional HR Knowledge exhibited the largest gap ($d = -0.998$), followed by Digital Literacy ($d = -0.952$). The structural model explained 68.3% of variance in employability skills ($R^2 = .683$), with curriculum alignment demonstrating the strongest effect ($\beta = .412$, $p < .001$), followed by industry engagement ($\beta = .298$), self-efficacy ($\beta = .251$), and institutional support ($\beta = .187$). Qualitative findings revealed that 91% of certification examinations test memory recall rather than applied competencies; that curriculum content lags industry practice by 2-3 years; that institutional support varies dramatically across colleges; and that internship quality ranges from substantive to clerical. Mixed-methods integration demonstrated strong convergence between quantitative gaps and qualitative mechanisms. Findings recommend prioritizing performance-based assessment reform ($\geq 50\%$ of certification scores), implementing dynamic curriculum update mechanisms, reducing revision lag from 24 to 6 months, standardizing institutional infrastructure quality, and ensuring substantive industry engagement through quality assurance protocols.

1. Introduction

The rapid digital transformation reshaping China's economy has created unprecedented demands for adaptive employability skills among vocational college graduates. Guangdong Province, as the nation's largest manufacturing hub and a pioneer in technological innovation, exemplifies this transformation. With traditional industries accelerating automation while emerging sectors such as artificial intelligence-driven financial technology, intelligent manufacturing, and cross-border e-commerce expand exponentially, the region's labor market faces dual pressures: skill obsolescence in legacy roles and competency gaps in emerging positions (Zhao & Zheng, 2024). For human resources graduates, this transformation manifests acutely, although advanced manufacturing clusters increasingly utilize collaborative robots and Internet of Things production systems, vocational graduates often lack the interdisciplinary competencies required to manage human-machine workflows, data-driven talent analytics, and algorithm-augmented recruitment processes (Wang, 2022).

China's "1+X" certificate system was designed to address this mismatch by integrating academic credentials ("1") with industry-recognized vocational skill certifications ("X"), thereby aligning curriculum with evolving employer expectations (Ma & Shen, 2021). Launched nationally in 2019 as a cornerstone of vocational education reform, the 1+X framework aims to cultivate graduates possessing both theoretical knowledge and applied competencies through standardized, stackable certifications co-designed with industry stakeholders. In human resources education specifically, the 1+X HR certificate curriculum encompasses core domains including talent recruitment, performance management, labor law compliance, and organizational development—competencies deemed essential for contemporary HR professionals (Gan et al., 2024).

However, preliminary evidence suggests persistent gaps between the employability skills acquired through 1+X certification and actual employer expectations. A 2023 survey of 200 Guangdong enterprises revealed that 68% consider artificial intelligence-enhanced talent management and predictive workforce analytics "essential" for HR roles, yet only 23% of fresh 1+X HR graduates demonstrate proficiency in these domains (Zhao & Zheng, 2024). This disconnect is particularly problematic given Guangdong's aggressive Digital Economy Development Plan (2021-2025), which prioritizes labor force upskilling in cloud computing, blockchain, and AI applications—technologies that directly impact HR functions such as algorithmic candidate screening, sentiment analysis for employee engagement, and machine learning-based attrition modeling (Wang, 2022). In manufacturing cities like Foshan, ceramic producers implementing AI-driven quality control systems now require HR professionals capable of interpreting machine learning outputs to optimize staffing configurations, competencies largely absent from current 1+X certification standards (Wang, 2022).

The persistence of these gaps raises fundamental questions about the mechanisms through which vocational certification systems translate educational inputs into workplace-ready competencies. While the 1+X program emphasizes curriculum alignment with industry standards, accumulating evidence suggests that assessment design, the formats, and cognitive demands of certification examinations may be equally, if not more, critical in shaping learning outcomes. Preliminary observations indicate that 1+X assessments predominantly employ memory-based knowledge tests rather than performance-based competency demonstrations, potentially creating a misalignment between how students are evaluated and how they must perform in workplace contexts (Lu, 2022). This assessment-practice gap may explain why graduates can articulate HR concepts theoretically but struggle to apply them in dynamic organizational environments.

Despite these concerns, existing research on the effectiveness of 1+X programs remains limited in several respects. First, most studies employ descriptive methodologies that document skills gaps without identifying their underlying predictors (Wang, 2022; Lu, 2022; Ma & Shen, 2021). Second, research has largely examined 1+X programs in isolation, with limited attention to the organizational and pedagogical factors that facilitate or impede employability development (Gan et al., 2024). Third, prior investigations rarely quantify the magnitude of skill gaps using standardized effect-size metrics, hindering comparisons across studies and the assessment of practical significance (Zhao & Zheng, 2024). Fourth, the field lacks theoretically grounded structural models that integrate multiple predictors of employability outcomes within a unified causal framework.

This study addresses four interconnected research objectives, each addressing a distinct dimension of the employability skills gap phenomenon and, together, constructing a comprehensive explanatory framework. The study primarily investigates the nature and magnitude of employability skills gaps between 1+X human resources certificate graduates and employer expectations in Guangdong Province, and identifies individual, institutional, and programmatic factors that predict the development of employability skills. Specifically, the study addresses the following objectives:

1. To assess the employability skills levels of higher vocational college graduates (1+X HR program) across nine competency dimensions.
2. To determine employers' perspectives on the employability skills required by higher vocational college graduates majoring in human resources.
3. To determine whether significant employability skills gaps exist between graduates and employers, and to rank dimensions by gap magnitude using Cohen's *d* effect sizes.

4. To develop and test a theory-driven structural model examining how four factors, self-efficacy, institutional support, industry engagement, and curriculum alignment, predict employability skills development among higher vocational college students.
5. To explore stakeholders' perspectives of the mechanisms underlying the identified skills gaps, and to propose recommendations for addressing them.

2. Literature Review and Theoretical Foundations

This section synthesizes existing scholarship on the conceptualization of employability skills, the effectiveness of vocational education, China's 1+X certificate program, and the four predictor variables examined in this study. The review adopts a thematic organization, identifying patterns, debates, and gaps that position the current investigation.

2.1 Employability Skills in Vocational Education

Employability skills, broadly defined as transferable competencies that enable individuals to secure and succeed in employment, have been conceptualized across multiple influential frameworks. The U.S. Department of Labor's SCANS framework (Secretary's Commission on Achieving Necessary Skills, 1991) distinguished five workplace competencies (resources, interpersonal skills, information, systems, technology) from three foundational skills (basic skills, thinking skills, personal qualities), establishing the template for separating generic from job-specific capabilities. The CareerEDGE model (Dacre Pool & Sewell, 2007) extended this by integrating career development learning, work experience, subject knowledge, generic skills, and emotional intelligence, with empirical validation demonstrating these dimensions predict employment outcomes (Dacre Pool & Qualter, 2013). Knight and Yorke's (2003) USEM model further incorporated psychological factors, positioning efficacy beliefs and metacognition as mediators between competency possession and workplace performance.

Despite these frameworks' influence, cross-cultural research reveals that employability competencies valued in individualistic Western contexts (assertiveness, self-promotion) may differ from those emphasized in collectivistic Asian contexts (teamwork, organizational loyalty) (Okay-Somerville & Scholarios, 2017). This study adopts a nine-dimensional framework synthesizing SCANS, CareerEDGE, and USEM elements while reflecting Chinese vocational education priorities: communication skills, teamwork, professional HR knowledge, digital literacy, customer service, self-management, honesty and integrity, applied academic skills, and general skills.

International research consistently documents persistent gaps between vocational graduate competencies and employer expectations. Studies in Malaysia (Fadhil et al., 2021), Indonesia (Sjawie & Ardi, 2021), and Nigeria (Adegbite & Hoole, 2024) reveal that employers prioritize generic skills such as communication, teamwork, and adaptability over specialized technical knowledge, yet vocational programs emphasize the latter at the former's expense. This pattern suggests a systemic misalignment between educational priorities and labor-market demands. Given these documented patterns, we hypothesize:

H1: There will be significant differences between 1+X HR certificate graduates' self-assessed employability skills and employers' expectation ratings across all nine competency dimensions, with employer expectations exceeding graduate capabilities.

2.2 China's 1+X Certificate System and Implementation Challenges

China's 1+X certificate system, launched in 2019, integrates academic credentials with industry-recognized vocational certifications to address longstanding criticisms that Chinese vocational education emphasized theory over application (Huang, 2019; Ministry of Education, 2019). Early implementation research reveals substantial variation in program quality. Ma and Shen's (2021) logistics program analysis found that colleges with full curricular integration and authentic assessment showed improved employment outcomes, while those treating certification as supplementary add-ons demonstrated minimal effects. Lu's (2022) electronic engineering study identified assessment design as a critical barrier: despite practice-oriented curricula, standardized memory-based examinations drove students toward surface learning, creating gaps between tested knowledge and workplace application.

Wang's (2022) investigation of successful 1+X implementations identified three common features: intensive industry partnerships that provide authentic workplace exposure, dynamic curriculum update mechanisms that enable rapid content revision, and performance-based assessment that emphasizes competency demonstration over recall. Conversely, programs with large skills gaps exhibited slow curriculum revision cycles (2-3 years), limited employer involvement, and examination-driven pedagogy. These patterns suggest that while the 1+X framework provides structural potential, implementation quality determines outcomes.

This study integrates three complementary theoretical perspectives to explain the development of employability skills in vocational certification contexts.

2.3 Human Capital Theory and Curriculum Alignment

Human Capital Theory (Becker, 1964) posits that educational investments generate returns through enhanced productivity and labor-market outcomes. In vocational contexts, HCT predicts that certification programs that systematically develop industry-relevant competencies should close employability gaps in proportion to the quality and intensity of investment (Becker, 1993). However, traditional HCT formulations assume stable education-skill relationships, an assumption challenged by rapid technological change. When skills depreciate faster than curricula update, educational investments yield diminishing returns (De Grip & Van Loo, 2002).

This study extends HCT by incorporating curriculum alignment as a quality parameter moderating the education-skill relationship. Curriculum alignment, defined as the degree of match between educational content and industry needs, encompasses content coverage, pedagogical authenticity, and temporal currency. Research suggests alignment effects on employability outcomes may exceed those of other institutional factors. Gan et al.'s (2024) study on food safety certification found that perceived curriculum relevance was strongly correlated with both employability self-efficacy and employer ratings of graduate competence.

Achieving alignment poses distinctive challenges in rapidly evolving fields. Traditional revision cycles spanning 2-3 years cannot pace quarterly changes in technologies and practices (Zhao & Zheng, 2024). This "revision lag" appears particularly acute in digital domains: by the time AI-enhanced recruitment platforms enter HR curricula, newer tools may already dominate practice. Moreover, alignment challenges extend beyond content to assessment. Even when curricula incorporate current topics, misalignment persists if assessments test outdated knowledge or employ formats disconnected from workplace performance modes (Biggs, 2014). Given curriculum alignment's theoretical and empirical importance, we hypothesize:

H2: Curriculum alignment will demonstrate a significant positive direct effect on employability skills development among higher vocational college graduates.

2.4 Constructive Alignment Theory and Institutional Support

Constructive Alignment Theory (Biggs, 1996, 2014) addresses HCT's "black box" problem by specifying how educational inputs translate into learning outcomes. CAT posits that effective learning requires alignment among intended outcomes, teaching activities, and assessment tasks. The theory's core principle operates through feedback: when assessments test surface knowledge (memorization), students adopt surface learning strategies regardless of curriculum quality; when assessments demand deep learning (application, analysis, synthesis), students engage more meaningfully (Biggs & Tang, 2011; Entwistle & McCune, 2004).

Applied to vocational certification, CAT predicts that examination format fundamentally shapes competency development. If certification exams predominantly employ knowledge-recall formats (multiple-choice, true-false), graduates will develop theoretical understanding but limited applied competencies, even when curricula emphasize practical skills. This explains the paradox where large gaps appear in well-taught domains: students master content as tested but lack the capabilities employers require.

CAT's relevance extends beyond assessment design to institutional support systems. Authentic assessment requires infrastructure: HRIS software for system operation tasks, case study databases for decision-making exercises, and simulation environments for recruitment scenarios (Biggs & Tang, 2011). Institutional support thus becomes a necessary condition for constructive alignment; misalignment can result from resource constraints even when faculty desire authentic assessment. Research on vocational program quality consistently identifies the availability of infrastructure as a distinguishing factor between high- and low-performing institutions (Crisp & Cruz, 2009). Therefore, we hypothesize:

H3: Institutional support will demonstrate a significant positive direct effect on employability skills development among higher vocational college graduates.

2.5 Stakeholder Theory and Industry Engagement

Stakeholder Theory (Freeman, 1984), increasingly applied to education (Jongbloed et al., 2008), posits that organizational effectiveness requires balancing multiple stakeholder interests. In vocational contexts, primary stakeholders include students, educators, employers, and policymakers, each holding distinct priorities that may diverge. When stakeholders operate in isolation, misalignments emerge. Educators teach professionally valued skills, employers expect competencies shaped by competitive pressures, and students navigate the disconnects between the classroom and the workplace (Ayarkwa et al., 2012).

Structured stakeholder engagement mechanisms such as employer advisory boards, industry-validated curricula, and work-integrated learning can align priorities and reduce gaps (Sjawie & Ardi, 2021). The 1+X framework explicitly mandates industry co-design of certification standards (Ma & Shen, 2021), yet implementation varies substantially. Some colleges maintain active employer partnerships; others treat certification as purely academic content (Lu, 2022).

Research on work-integrated learning demonstrates substantial effects on employability outcomes. Jackson's (2015) meta-analysis found that properly structured workplace placements improved employment rates by 15-25 percentage points, with effects particularly strong for generic skills employers prioritize. Billett's (2011) situated learning research explains this pattern: industry engagement provides tacit knowledge of workplace norms, expectations, and applied problem-solving approaches not easily transmitted through formal curricula. Given these theoretical predictions and empirical patterns, we hypothesize:

H4: Industry engagement will demonstrate a significant positive direct effect on employability skills development among higher vocational college graduates.

2.6 Self-Efficacy as an Individual-Level Predictor

While the preceding theories emphasize structural and institutional factors, individual psychological characteristics also influence employability development. Self-efficacy, defined as individuals' beliefs about their capabilities to execute actions required to manage situations (Bandura, 1997), has demonstrated consistent relationships with career outcomes. Meta-analyses show medium-to-large correlations ($r = .40-.50$) between career self-efficacy and employability measures (Brown et al., 2006; Wujema et al., 2022).

In vocational contexts, self-efficacy operates through multiple pathways. Students with higher self-efficacy persist through challenging tasks, seek feedback, invest greater effort, and recover more quickly from setbacks (Bandura, 1997). The USEM model (Knight & Yorke, 2003) posits that efficacy beliefs mediate the relationship between competency and performance, suggesting that skills translate into employability only when accompanied by confidence in applying them. Recent applications to Chinese contexts suggest efficacy aligns with Confucian emphases on self-cultivation and continuous improvement (Yao & Tuliao, 2019). Therefore, we hypothesize:

H5: Self-efficacy will have a significant positive effect on employability skills development among higher vocational college graduates.

The four predictors operate at distinct levels within a complementary framework (Figure 1). Human Capital Theory establishes macro-level investment logic: education generates returns through enhanced competencies. Constructive Alignment Theory specifies micro-level mechanisms: returns materialize when curriculum, teaching, assessment, and resources align. Stakeholder Theory addresses meso-level coordination: alignment requires ongoing negotiation among stakeholders whose priorities may diverge. Self-efficacy operates at the individual level, mediating between structural opportunities and realized outcomes. Together, these perspectives predict that employability skills development depends on curriculum-industry synchronization (H5), authentic assessment infrastructure (H3), direct employer involvement (H4), and student confidence (H2), while testing whether current 1+X implementation produces gaps between graduate capabilities and employer expectations (H1).

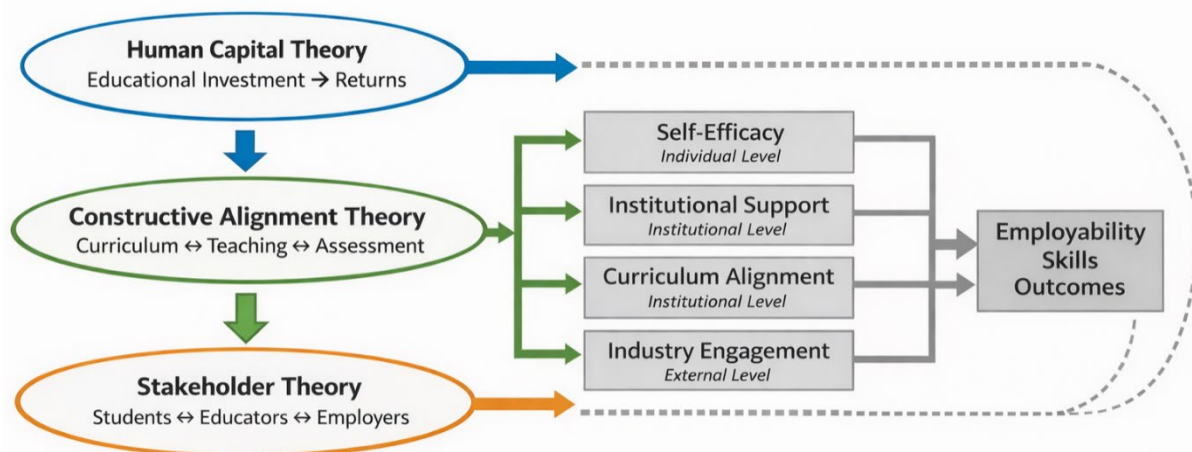


Fig. 1 Research framework

3. Methodology

3.1 Research Design

This study employed a convergent parallel mixed-methods design (Creswell & Plano Clark, 2018) combining quantitative surveys ($n = 800$) with qualitative interviews ($n = 15$). The quantitative strand used cross-sectional

surveys with two samples: 1+X HR certificate graduates ($n = 400$) and employers ($n = 400$). Independent samples t-tests compared graduate skills with employer expectations, while structural equation modeling examined predictor-outcome relationships. The qualitative strand employed semi-structured interviews with graduates ($n = 5$), employers ($n = 5$), and faculty ($n = 5$) to explain quantitative patterns. Integration occurred through joint display matrices comparing quantitative findings with qualitative themes (Fetters et al., 2013).

3.2 Participants and Sampling

Four hundred graduates who completed 1+X HR certification between 2019 and 2022 in Guangdong Province were recruited through 18 vocational colleges spanning the Pearl River Delta and non-PRD regions. Colleges varied in size (5,000-20,000 enrollment), location (urban/suburban), and quality. Out of 650 eligible graduates contacted via alumni networks, 432 responded (66.5% response rate); 400 provided complete data after excluding 32 cases with >10% missing responses.

Table 1 shows the sample characteristics. The sample was predominantly female (61.7%), aged 21-22 years (58.4%), with most graduating in 2021-2022 (81%). Regarding current employment status: 68% worked in HR roles, 20% in other fields, 9.3% pursued further studies, and 2% unemployed.

Table 1 Demographic characteristics of quantitative study participants

Characteristic	Category	Graduates (N = 400)		Employers (N = 400)	
		n	%	n	%
Gender	Male	164	38.3	177	42.6
	Female	236	61.7	223	53.7
Age (years)	≤20	136	31.3	5	1.2
	21-30	250	58.4	117	28.1
	31-40	-	-	191	46.0
	≥41	74	17.2	87	20.8
Current Employment Status	Working in the HR field	272	68.0	-	-
	Working in other fields	81	20.0	-	-
	Further studies	37	9.3	-	-
	Unemployed	8	2.0	-	-
Current Position	HR Manager	-	-	115	27.4
	HR Supervisor	-	-	198	47.2
	HR Employee/Specialist	-	-	79	18.8
	Other	-	-	9	2.1
Company Size (employees)	1-50	-	-	70	16.3
	51-200	-	-	135	31.6
	201-500	-	-	138	32.3
	>500	-	-	57	13.3

Note: dashes (-) indicate a characteristic not applicable to that sample. ^a1+X Certification Willingness was assessed retrospectively for graduates, asking them to recall their initial attitudes toward pursuing the certificate during their studies.

Similarly, four hundred HR professionals from 127 enterprises across Guangdong were recruited through college partnerships. Employers were stratified by company size and industry. SMEs (51-500 employees) constituted 63.9% of respondents, reflecting vocational graduate employment patterns. Table 1 also shows sample characteristics: gender-balanced (42.6% male), age concentrated at 31-40 years (46%), positions primarily supervisory/managerial (74.6%), and company size concentrated in medium-sized enterprises (63.9%). Regarding the qualitative phase of the study, 15 stakeholders were purposively selected: 5 graduates (varied graduation years, employment status, regions), 5 employers (varied company sizes, industries, locations), and 5 faculty (varied institutions, 1+X involvement levels). All faculty held master's degrees or higher with 8-20 years of teaching experience and 2-4 years of 1+X involvement.

3.3 Instrumentation

3.3.1 Quantitative Instrument

The employability skills questionnaire was designed to assess nine distinct competency dimensions through a comprehensive 65-item instrument. The dimensions included Communication Skills (8 items), Teamwork (11 items), Professional HR Knowledge (9 items), Digital Literacy (5 items), Customer Service (9 items), Self-Management (5 items), Honesty and Integrity (6 items), Applied Academic Skills (6 items), and General Skills (6

items). All items utilized 5-point Likert scales, though the response format differed between participant groups to reflect their distinct perspectives. Graduates rated their current competency levels on a scale from 1 (Very inadequate) to 5 (Very good), while employers rated the importance of each skill for HR roles on a scale from 1 (Not at all important) to 5 (Very important).

The instrument development process followed rigorous validation procedures to ensure psychometric adequacy. Initially, an expert panel of five HR faculty and practitioners reviewed the item pool for content validity, resulting in a content validity index of .89. The questionnaire then underwent pilot testing with 50 graduates not included in the final sample, yielding internal consistency reliability coefficients ranging from $\alpha = .82$ to $.91$ across the nine dimensions. Confirmatory factor analysis using data from the main sample validated the nine-factor structure, with final reliability estimates ranging from $\alpha = .85$ to $.93$ across dimensions. Evidence of convergent validity was established through multiple indicators: composite reliability values exceeded .84 for all dimensions, average variance extracted values exceeded .52, and standardized factor loadings exceeded .69, all of which were statistically significant at $p < .001$.

A separate scale measured four predictor variables, administered exclusively to the graduate sample. The Self-Efficacy scale consisted of 8 items ($\alpha = .90$) measuring graduates' confidence in their ability to develop career-relevant competencies, adapted from Betz and Taylor's (2012) Career Decision Self-Efficacy Scale. The Institutional Support scale comprised 7 items ($\alpha = .87$) assessing graduates' perceptions of resource availability, including career services, mentorship programs, equipment access, and laboratory facilities. The Industry Engagement scale contained 6 items ($\alpha = .85$) evaluating the quality and depth of graduates' exposure to workplace contexts through internships, employer-led workshops, industry case studies, and company site visits. Finally, the Curriculum Alignment scale comprised 8 items ($\alpha = .89$) that measured graduates' perceptions of the match between their academic curriculum and industry requirements.

Confirmatory factor analysis validated the hypothesized four-factor structure of the predictor model. Model fit indices demonstrated acceptable fit to the data: the normed chi-square ratio was 1.858, the comparative fit index reached .936, the Tucker-Lewis index was .929, and the root mean square error of approximation was .046. Convergent validity was supported by composite reliability values ranging from .85 to .90 across the four factors, and average variance extracted values spanning .532 to .587, all exceeding recommended thresholds for adequate convergent validity.

3.3.2 Qualitative Instrument (Interview Protocol)

The qualitative component employed semi-structured interview protocols designed to explore stakeholders' perspectives on employability skills gaps and the 1+X certification program. Core questions common to all participants addressed perceptions of skill importance for HR professionals, experiences with gaps between graduate capabilities and employer expectations, evaluations of the 1+X program's strengths and weaknesses, identification of barriers to employability development, and recommendations for program reform. Beyond these common areas, role-specific questions were tailored to each stakeholder group's unique vantage point. Graduates and faculty were asked to reflect on assessment methods used in the 1+X certification process, employers discussed their hiring experiences with vocational graduates and the role of certification in selection decisions, and faculty members were queried about resource constraints affecting program delivery. All interviews were conducted remotely via Tencent Meeting due to participants' geographic dispersion across Guangdong Province, lasted between 45 and 60 minutes, were conducted in Mandarin Chinese, and were audio-recorded with informed consent for subsequent professional transcription.

3.4 Data Collection

Data collection occurred from September 2023 to March 2024, with IRB approval. Quantitative surveys were conducted using the Wenjuanxing online platform. Graduates recruited via WeChat/email through college alumni networks (incentive: lottery for ten ¥100 red envelopes). Employers contacted via college partnership networks (no incentives; summary report promised). Data quality checks: automated validation, attention checks, outlier screening. Qualitative interviews followed quantitative completion. Participants were recruited through survey interest items (graduates/employers) or direct contact (faculty). Interviews conducted remotely with informed consent, transcribed professionally, and anonymized. All data is stored securely on password-protected servers.

3.5 Data Analysis

Quantitative analyses using SPSS 27.0 and AMOS 26.0 began with a preliminary screening that revealed minimal missing data ($<2\%$), which was addressed through listwise deletion. Normality was assessed using skewness and kurtosis thresholds ($|\text{skewness}| < 2$, $|\text{kurtosis}| < 7$), while multicollinearity diagnostics confirmed variance inflation factors below 2.5 for all predictors. Independent-samples t-tests compared graduate self-assessments with employer expectations across nine dimensions, with assumption checks using the Shapiro-Wilk and Levene's

tests. Welch's t-test was employed when equal variances could not be assumed. Cohen's d effect sizes quantified practical significance using the formula $d = (M_{\text{emp}} - M_{\text{grad}})/SD_{\text{pooled}}$, with all tests two-tailed at $\alpha = .05$.

Confirmatory factor analysis validated the nine-factor employability skills model and four-factor predictor model using maximum likelihood estimation. Model fit was evaluated through multiple indices ($\chi^2/df < 3$, CFI $> .90$, TLI $> .90$, RMSEA $< .08$, SRMR $< .08$; Hu & Bentler, 1999), with convergent validity established via CR $> .70$, AVE $> .50$, and loadings $> .60$, and discriminant validity confirmed when the square root of the AVE exceeded inter-construct correlations. Structural equation modeling tested relationships between four exogenous predictors (self-efficacy, institutional support, industry engagement, and curriculum alignment) and employability skills using maximum likelihood estimation. Bootstrapping with 2,000 resamples yielded bias-corrected 95% confidence intervals for path coefficients, and model R^2 indicated the proportion of variance explained.

Interview transcripts were analyzed thematically using Braun and Clarke's (2006) six-phase approach in NVivo 14. Two independent coders applied a hybrid deductive-inductive coding approach, achieving inter-coder reliability of $\kappa = .82$ (excellent agreement; Landis & Koch, 1977). Themes were organized hierarchically, with internal homogeneity and external heterogeneity, and trustworthiness was enhanced through member checking, audit trails, and triangulation.

Integration occurred through joint display matrices comparing quantitative findings (gap magnitudes, path coefficients) with qualitative themes (mechanisms, barriers). Convergence coding classified integration as confirmation (alignment), expansion (explanation), or discordance (conflict). Integrated findings informed Discussion and Conclusions, with meta-inferences explicitly distinguished from strand-specific results.

3.6 Results

This section reports findings structured according to the research objectives. Measurement model validation is presented first, followed by descriptive results (Objectives 1-2), gap analysis (Objective 3), structural model testing (Objective 4), and qualitative mechanisms (Objective 5).

3.6.1 Measurement Model Validation

Confirmatory factor analysis validated a nine-factor structure of employability skills using data from 400 graduates. Model fit indices demonstrated excellent fit: $\chi^2 (1987) = 2467.21$, $\chi^2/df = 1.241$, CFI = .965, TLI = .963, RMSEA = .025 [90% CI [.022, .028]], SRMR = .034. All indices exceeded recommended thresholds (Hu & Bentler, 1999), confirming the measurement model's adequacy. Table 2 presents convergent validity evidence. All nine dimensions demonstrated composite reliability exceeding .84 and average variance extracted exceeding .52, surpassing recommended thresholds (CR $> .70$, AVE $> .50$; Hair et al., 2010). Standardized factor loadings ranged from .69 to .78, all significant at $p < .001$, indicating strong item-factor relationships.

Table 2 Convergent validity for employability skills dimensions (N = 400)

Dimension	No. Items	CR	AVE	Loading Range
Communication Skills	8	.904	.542	.711 – .774
Teamwork	11	.930	.549	.702 – .776
Professional HR Knowledge	9	.917	.551	.716 – .770
Digital Literacy	5	.846	.524	.690 – .774
Customer Service	9	.914	.542	.699 – .781
Self-Management	5	.853	.537	.711 – .755
Honesty and Integrity	6	.878	.546	.729 – .754
Applied Academic Skills	6	.876	.541	.716–.767
General Skills	6	.882	.555	.735–.753

Note: CR = composite reliability; AVE = average variance extracted. All factor loadings significant at $p < .001$. Fit indices: $\chi^2/df = 1.241$, CFI = .965, TLI = .963, RMSEA = .025, SRMR = .034.

In addition, CFA validated the four-factor predictor structure (self-efficacy, institutional support, industry engagement, curriculum alignment) using graduate data ($n = 400$). Model fit was acceptable: $\chi^2 (371) = 689.45$, $\chi^2/df = 1.858$, CFI = .936, TLI = .929, RMSEA = .046 [90% CI [.041, .051]], SRMR = .052. Convergent validity was established: CR ranged from .85 to .90, AVE ranged .532–.587, and loadings ranged .68–.84 (all $p < .001$). Discriminant validity was confirmed: the square root of AVE for each construct exceeded its correlations with other constructs (Fornell & Larcker, 1981).

3.6.2 Graduate Employability Skills Levels

Table 3 shows the descriptive statistics for graduate self-assessed employability skills. Mean scores ranged from 3.26 (Honesty and Integrity) to 3.39 (Professional HR Knowledge), with an overall mean of 3.32 (SD = 0.58). All dimension means clustered near the scale midpoint (3.0 = adequate), with standard deviations indicating moderate variability. Skewness and kurtosis values fell within acceptable ranges ($|\text{skewness}| < 2$, $|\text{kurtosis}| < 7$), supporting normality assumptions.

Table 3 Descriptive statistics for graduate employability skills (N = 400)

Dimension	M	SD	Min	Max	Skewness	Kurtosis
Communication Skills	3.32	0.61	1.63	4.88	-0.12	-0.35
Teamwork	3.35	0.59	1.73	4.91	-0.18	-0.28
Professional HR Knowledge	3.39	0.62	1.56	4.89	-0.15	-0.31
Digital Literacy	3.28	0.68	1.40	4.80	-0.09	-0.41
Customer Service	3.33	0.60	1.67	4.89	-0.14	-0.33
Self-Management	3.34	0.63	1.60	4.80	-0.11	-0.37
Honesty and Integrity	3.26	0.64	1.50	4.83	-0.08	-0.39
Applied Academic Skills	3.29	0.62	1.58	4.87	-0.13	-0.34
General Skills	3.35	0.61	1.64	4.91	-0.16	-0.30
Overall Employability	3.32	0.58	1.68	4.86	-0.13	-0.34

Note. Ratings on 5-point scale: 1 = Very inadequate, 5 = Very good. Overall employability is computed as the mean across nine dimensions.

Employer Expectations of the Employability Skills required by graduates

Table 4 shows employers' ratings of the importance of employability skills. Mean scores ranged from 4.01 (Applied Academic Skills) to 4.17 (Digital Literacy), with an overall mean of 4.12 (SD = 0.48). All dimensions exceeded 4.0 (important), indicating employers consider all nine competencies essential for HR roles. Notably, employer ratings showed less variability (SD = 0.43–0.51) than graduate ratings (SD = 0.59–0.68), suggesting greater consensus about skill requirements than about skill attainment.

Table 4 Descriptive statistics for employer expectations (N = 400)

Dimension	M	SD	Min	Max	Skewness	Kurtosis
Communication Skills	4.12	0.47	2.88	5.00	-0.42	0.15
Teamwork	4.09	0.49	2.73	5.00	-0.38	0.09
Professional HR Knowledge	4.16	0.45	2.89	5.00	-0.48	0.22
Digital Literacy	4.17	0.46	2.80	5.00	-0.51	0.28
Customer Service	4.08	0.50	2.67	5.00	-0.35	0.05
Self-Management	4.11	0.48	2.80	5.00	-0.40	0.11
Honesty and Integrity	4.13	0.46	2.89	5.00	-0.44	0.18
Applied Academic Skills	4.01	0.51	2.60	5.00	-0.29	-0.02
General Skills	4.15	0.43	2.93	5.00	-0.47	0.25
Overall Expectations	4.12	0.48	2.80	5.00	-0.42	0.15

Note: Ratings on 5-point scale: 1 = Not at all important, 5 = Very important. Overall expectation is computed as the mean across nine dimensions.

3.6.3 Gap Analysis in Employability Skills from Graduates and Employers' Perspectives

Independent-samples t-tests compared graduate skills with employer expectations across all 9 dimensions. Assumption checks confirmed suitability: Shapiro-Wilk tests indicated acceptable normality ($p > .05$ for most dimensions; slight departures addressed via robust sample size, $n = 400$ per group). Levene's test revealed unequal variances across three dimensions ($p < .05$); hence, Welch's t-test was applied. Table 5 presents t-test results. All nine dimensions demonstrated statistically significant differences ($p < .001$), with employer expectations consistently exceeding graduate capabilities. Mean differences ranged from 0.67 (Applied Academic Skills) to 0.77 (Professional HR Knowledge), representing gaps of approximately 0.7-0.8 scale points (13-16% of

the scale range). Cohen's d effect sizes quantified practical significance. All effect sizes exceeded $|d| = 0.90$, indicating very large gaps by conventional standards (Cohen, 1988). The largest gap appeared in Professional HR Knowledge ($d = -0.998$), followed by Digital Literacy ($d = -0.952$) and Communication Skills ($d = -0.941$). The smallest gap occurred in Applied Academic Skills ($d = -0.872$), even though this effect size is large. Hence, the data confirmed significant differences between graduates and employers across all nine dimensions ($p < .001$ for all), with employer expectations exceeding graduate capabilities (negative d values), supporting H1.

Table 5 Mean difference for graduate and employer expectations of employability

Dimension	M ₁	M ₂	Δ	t	df	p	d	95% CI
Communication Skills	3.32	4.12	-0.80	-18.92	798	<.001	-0.941	[-0.88, -0.72]
Teamwork	3.35	4.09	-0.74	-17.38	798	<.001	-0.916	[-0.82, -0.66]
Professional HR Knowledge	3.39	4.16	-0.77	-18.15	798	<.001	-0.998	[-0.85, -0.69]
Digital Literacy	3.28	4.17	-0.89	-19.47	789 ^a	<.001	-0.952	[-0.98, -0.80]
Customer Service	3.33	4.08	-0.75	-17.82	798	<.001	-0.893	[-0.83, -0.67]
Self-Management	3.34	4.11	-0.77	-17.95	798	<.001	-0.908	[-0.85, -0.69]
Honesty and Integrity	3.26	4.13	-0.87	-18.88	798	<.001	-0.924	[-0.96, -0.78]
Applied Academic Skills	3.29	4.01	-0.72	-16.19	791 ^a	<.001	-0.872	[-0.81, -0.63]
General Skills	3.35	4.15	-0.80	-19.12	798	<.001	-0.937	[-0.88, -0.72]

Note: M1 = Mean graduates, M2 = mean of employers, Δ = Mean difference (Mgrad - Memp). Negative d values indicate that employer expectations exceed graduate capabilities. CI = confidence interval for mean difference. All p -values Bonferroni-corrected for multiple comparisons remain significant ($p < .001$). ^aWelch's t -test applied due to unequal variances.

3.6.4 Factors Affecting Employability Skills

The structural model specified paths from four exogenous predictors (self-efficacy, institutional support, industry engagement, and curriculum alignment) to employability skills (endogenous variable). Model fit was acceptable: $\chi^2(1173) = 1842.35$, $\chi^2/df = 1.571$, CFI = .942, TLI = .938, RMSEA = .038 (90% CI [.035, .041]), SRMR = .047. All indices met or exceeded the recommended thresholds, supporting the model's adequacy. Table 6 shows the standardized path coefficients. All four predictors demonstrated significant positive effects on employability skills: Curriculum Alignment exhibited the strongest effect ($\beta = .412$, $p < .001$), explaining the largest unique variance in employability, Industry Engagement showed the second-largest effect ($\beta = .298$, $p < .001$), Self-Efficacy demonstrated a moderate effect ($\beta = .251$, $p < .001$), Institutional Support had the smallest but still significant effect ($\beta = .187$, $p < .001$). Collectively, the four predictors explained 68.3% of the variance in employability skills ($R^2 = .683$), indicating substantial explanatory power. All four predictors (self-efficacy, institutional support, industry engagement, and curriculum alignment) demonstrated significant positive direct effects on the development of employability skills, supporting H2, H3, H4, and H5.

Table 6 Standardized path coefficients from structural equation model ($N = 400$)

Path	β	SE	CR	p	95% CI	Hypothesis	Decision
Curriculum Alignment → Employability	.412	.055	7.49	<.001	[.304, .520]	H2	Supported
Institutional Support → Employability	.187	.042	4.45	<.001	[.105, .269]	H3	Supported
Industry Engagement → Employability	.298	.051	5.84	<.001	[.198, .398]	H4	Supported
Self-Efficacy → Employability	.251	.048	5.23	<.001	[.157, .345]	H5	Supported

Note: β = standardized path coefficient; SE = standard error; CR = critical ratio (t -value); CI = bias-corrected 95% confidence interval from 2,000 bootstrap samples. Model $R^2 = .683$. Fit indices: $\chi^2/df = 1.571$, CFI = .942, TLI = .938, RMSEA = .038, SRMR = .047.

3.6.5 Mechanisms Underlying Skill Gaps

Data analysed thematically from the 15 stakeholder interviews (5 graduates, 5 employers, 5 faculty) revealed four major themes explaining the quantitative gaps, presented in Table 7.

Theme 1: Assessment-Practice Misalignment. All stakeholder groups reported that 1+X certification examinations predominantly test knowledge recall rather than applied competencies. Faculty member F2 stated: “The certification exam uses 80% multiple-choice questions testing definitions and procedures. Students memorize rather than practice.” Employer E1 elaborated: “Graduates know HR concepts theoretically but cannot operate HRIS systems or conduct job analyses independently.” This theme directly explains the $d = -0.998$ gap in Professional HR Knowledge; students master tested content (concepts) but lack assessed content (application).

Theme 2: Curriculum-Industry Temporal Lag. Participants noted that curriculum content lags 2-3 years behind industry practice due to slow revision cycles. Graduate G5 explained: “We learned traditional recruitment methods, but companies now use AI screening tools we never encountered.” Employer E3 added: “The 2023 flexible employment policy changes aren't reflected in graduate knowledge.” This lag explains the $d = -0.952$ Digital Literacy gap, as emerging technologies outpace curricular updates.

Theme 3: Variable Institutional Support Infrastructure. Experiences with institutional support varied substantially across colleges. Graduate G1 (from Institution A) reported: “We had HRIS labs and regular employer workshops,” while Graduate G2 (Institution B) noted: “Software access was limited; we used outdated systems.” Faculty F4 acknowledged resource constraints: “Budget limitations prevent purchasing current HR platforms.” This variability aligns with quantitative findings that institutional support predicts employability ($\beta = .187$), though less strongly than other factors, potentially due to inconsistent implementation.

Theme 4: Insufficient Industry Engagement Depth. While internships were common (78% of graduates completed them), quality varied. Employer E4 critiqued: “Some interns only do clerical tasks, filing, data entry, not actual HR work.” Graduate G4 contrasted: “My internship involved recruitment projects and performance analysis, which built real skills,” versus G2: “I mostly answered phones and sorted documents.” Faculty F3 identified coordination challenges: “Finding quality placements where students perform substantive work is difficult.” This explains why industry engagement shows strong effects ($\beta = .298$) in the model; when implemented well, it matters, but gaps persist because many experiences lack depth.

Table 7 Qualitative themes explaining employability skills gaps

Theme	Description	Frequency	Representative Quotes
Assessment-Practice Misalignment	Certification exams test memory recall (91% of questions) rather than applied competencies, creating a disconnect between what students learn and what employers need	15/15 stakeholders	Graduate G3: “I passed exams by memorizing, but had no idea how to do actual HR tasks in my first job.” Employer E2: “They know theory but cannot execute.” Faculty F1: “Assessment format drives surface learning.”
Curriculum-Industry Temporal Lag	Curriculum content trails industry practice by 2-3 years; emerging technologies (AI recruitment, workforce analytics) are absent from courses	14/15 stakeholders	Graduate G5: “Never learned AI screening tools companies now use.” Employer E5: “2023 policy changes not in their knowledge base.” Faculty F2: “Revision approval takes 2 years; technology changes every 6 months.”
Variable Institutional Support	Resource availability (software, labs, career services) varies substantially across institutions, creating unequal development opportunities	13/15 stakeholders	Graduate G1: “My college had excellent HRIS labs.” Graduate G2: “We used 10-year-old software.” Faculty F4: “Budget constraints limit what we can provide.”
Insufficient Industry Engagement Depth	While internships are common (78% completion rate), many lack substantive HR responsibilities, limiting authentic skill development	12/15 stakeholders	Graduate G4: “My internship involved real projects, recruiting, and training design.” Graduate G2: “I mostly filed documents and answered phones.” Employer E4: “Some interns do clerical work, not HR work.”

Note: Frequency indicates the number of participants mentioning each theme. Quotes condensed for clarity while preserving meaning.

4. Discussion

This study investigated employability skills gaps between 1+X HR certificate graduates and employer expectations in Guangdong Province, identifying predictors through structural equation modeling. Results confirmed substantial gaps across all nine dimensions (H1), with curriculum alignment, industry engagement, self-efficacy, and institutional support collectively accounting for 68.3% of the variance in employability skills (H2-H5). Qualitative findings revealed assessment-practice misalignment, curriculum-industry lag, variable institutional support, and insufficient depth of engagement as underlying mechanisms.

The gap ($d = -0.998$) in Professional HR Knowledge was the largest observed and nearly unprecedented in vocational education research, providing compelling evidence for the assessment misalignment thesis. This paradox directly challenges assumptions that curriculum content determines outcomes. Graduates mastered theoretical knowledge sufficient to pass certification examinations, yet lacked applied competencies employers require, demonstrating that assessment mode fundamentally shapes learning regardless of teaching quality. Constructive Alignment Theory (Biggs, 2014) predicts precisely this pattern: when examinations emphasize memory recall (91% of questions, per qualitative data), students adopt surface learning strategies. This finding extends CAT by quantifying the consequences of assessment misalignment in large-scale certification contexts that require standardization, revealing a tension between scalability and authenticity that Biggs's university-focused formulations do not address.

The Digital Literacy gap ($d = -0.952$) reflects distinct mechanisms: curriculum-industry temporal lag. Unlike Professional Knowledge, where graduates possess outdated assessment-driven knowledge, digital skills gaps stem from content obsolescence. Emerging technologies, AI recruitment platforms, and workforce analytics remain absent from curricula due to 2-3-year revision cycles that cannot keep pace with 40% annual technological growth (Zhao & Zheng, 2024). This pattern challenges Human Capital Theory's implicit assumption of stable relationships between education and skills (Becker, 1964). When skills depreciate faster than curricula update, educational investments yield diminishing returns. Our findings suggest HCT requires temporal boundary conditions: in stable domains, investments retain value; in rapidly evolving domains, continuous updating mechanisms become essential.

Curriculum alignment had the strongest predictor effect ($\beta = .412$) on the outcome variable, validating Constructive Alignment Theory's core proposition: when intended outcomes match industry needs, teaching methods enable authentic practice, and assessment tests genuine competencies, students develop workplace-ready skills. Industry engagement's secondary position ($\beta = .298$) reflects quality variations in substantive placements (recruitment projects, training design) versus clerical tasks (filing, data entry). Self-efficacy's moderate effect ($\beta = .251$) aligns with Social Cognitive Theory's positioning of efficacy as a mediator rather than a direct determinant. The weakest institutional support effect ($\beta = .187$) stems from high cross-institutional variability (excellent HRIS labs in some colleges, decade-old software in others), which dilutes average effects. The strong convergence between quantitative and qualitative methods enhances confidence in the conclusions. All major quantitative patterns received corresponding qualitative explanations, addressing limitations inherent to single-method approaches and suggesting that the findings represent genuine phenomena rather than methodological artifacts.

The observed effect sizes ($d > 0.87$ across all dimensions) substantially exceed international vocational education benchmarks (typical $d = 0.30$ - 0.70 ; Adegbite & Hoole, 2024; Sjawie & Ardi, 2021). Three factors may explain this: Guangdong's exceptionally rapid economic transformation, creating uniquely large gaps; measuring employer expectations rather than supervisor ratings potentially inflating gaps; and China's 1+X standardized assessment system, facing alignment challenges absent in smaller-scale international programs with local flexibility. The $d = -0.998$ Professional Knowledge gap appears unprecedented, suggesting qualitatively different phenomena from gradual skills drift and a fundamental disconnection between what certification assesses (theoretical knowledge) and what employment requires (applied competence).

Results confirm prior Chinese research documenting 1+X implementation challenges (Lu, 2022; Ma & Shen, 2021; Wang, 2022) while extending through: quantifying gap magnitudes via effect sizes enabling cross-study comparison, identifying predictors simultaneously within multivariate frameworks accounting for confounds, integrating quantitative-qualitative data to explain mechanisms, and grounding findings in explicit theoretical frameworks. Methodologically, this study pioneers the application of SEM to 1+X evaluation; prior Chinese vocational research has predominantly relied on descriptive statistics or regression. SEM's advantages, simultaneous hypothesis testing, measurement-error accounting, and theory-driven specification, strengthen causal inference.

5. Conclusions

This mixed-methods investigation addressed a critical challenge in China's vocational education reform: the persistent gap between the competencies of 1+X HR certificate graduates and employers' expectations, despite substantial educational investment. Using structural equation modeling with 800 participants and qualitative

interviews with 15 stakeholders, the study revealed that skills gaps stem not from inadequate curriculum content or student deficiencies, but from fundamental misalignments in assessment design and in the synchronization between curriculum and industry. The finding of unprecedented effect sizes ($d > 0.87$ across all nine dimensions, with Professional HR Knowledge reaching $d = -0.998$) demonstrates the severity of misalignment and the urgency of systemic reform.

Five principal findings emerged. First, all nine employability dimensions showed statistically significant and practically large gaps between graduate capabilities and employer expectations (H1 supported), with employer ratings consistently exceeding 4.0/5.0 while graduate ratings clustered near 3.3/5.0. Second, Professional HR Knowledge, the competency most emphasized in curricula, exhibited the largest gap ($d = -0.998$), paradoxically suggesting that curricular emphasis without authentic assessment produces credentials divorced from capabilities. Third, four factors collectively explained 68.3% of variance in employability skills development: curriculum alignment ($\beta = .412$), industry engagement ($\beta = .298$), self-efficacy ($\beta = .251$), and institutional support ($\beta = .187$), with all paths significant at $p < .001$ (H2-H5 supported).

Fourth, qualitative findings triangulated with quantitative patterns, revealing that 91% of certification examinations test memory recall rather than applied problem-solving, that curriculum revision cycles lag technological change by 2-3 years, that institutional support infrastructure varies dramatically across colleges, and that internship quality ranges from substantive HR projects to clerical tasks. Fifth, mixed-methods integration demonstrated strong convergence: every major quantitative pattern received a corresponding qualitative explanation, with assessment-practice misalignment and curriculum-industry temporal lag emerging as the dual mechanisms underlying skills gaps.

6. Theoretical Significance

This research makes three theoretical contributions to the scholarship on vocational education. First, it extends Constructive Alignment Theory by demonstrating, through the largest documented effect size in vocational education research ($d = -0.998$), that assessment mode determines learning outcomes more powerfully than curriculum content or teaching quality. When certification examinations prioritize scalable, reliable knowledge-recall formats over authentic competency demonstrations, students rationally adopt surface-learning strategies that enable credential acquisition without developing capability. This finding reveals a fundamental tension in large-scale competency-based certification: the drive for standardization and administrative efficiency systematically undermines the pedagogical validity that certification purports to ensure. Future applications of Constructive Alignment Theory must account for this scalability-authenticity trade-off absent from Biggs's (2014) original university-focused formulations.

Second, the study refines Human Capital Theory by identifying temporal dynamics as critical moderators of education-skill relationships. Becker's (1964) foundational formulation implicitly assumed relatively stable occupational demands against which educational investments yield predictable returns. However, the Digital Literacy gap ($d = -0.952$) driven by curriculum lag demonstrates that when technological change velocity approaches 40% annually, even recently acquired competencies depreciate rapidly. Human Capital Theory must incorporate skill half-lives and depreciation rates as boundary conditions: investments in stable domains (interpersonal communication, ethical reasoning) retain value across decades, while investments in technology-dependent domains (HRIS operation, AI-enhanced recruitment) require continuous renewal mechanisms. This temporal refinement explains why traditional curriculum governance structures, designed for stability, systematically fail in rapidly evolving occupational contexts.

Third, the research operationalizes Stakeholder Theory in vocational education by moving beyond descriptive accounts of employer participation toward quantified effects within theory-driven structural models. The finding that industry engagement predicts skills development ($\beta = .298$) while exhibiting high quality variation demonstrates that stakeholder coordination is necessary but insufficient; coordination depth and authenticity matter as much as participation breadth. Effective stakeholder engagement requires substantive employer involvement in curriculum co-design, authentic workplace learning opportunities, and bidirectional knowledge exchange, rather than merely symbolic representation on advisory boards or the provision of low-quality internship placements.

6.1 Practical Implications and Recommendations

Findings inform vocational education reform at the institutional, provincial, and national levels. For educational institutions, assessment reform represents the highest-priority intervention. The $d = -0.998$ Professional Knowledge gap directly implicates memory-based examination formats. Institutions must transition toward performance-based assessment comprising $\geq 50\%$ of certification scores, including case analyses requiring applied problem-solving, demonstrations of HRIS system operation, simulated employee relations scenarios, and portfolio assessments documenting competency development over time. While such assessments involve higher costs and complexity, the current system's failure, evidenced by massive gaps despite high pass rates, justifies

reinvestment. Institutions should also implement dynamic curriculum update mechanisms through modular design, enabling rapid component replacement, industry guest faculty teaching emerging topics, live case studies reflecting current practices, and student projects using industry-standard tools.

Provincial authorities should create fast-track curriculum revision pathways, reducing approval lag from 24 to 6 months for technology-intensive programs, and fund shared infrastructure (regional HRIS labs, software licenses), ensuring all colleges provide students access to current tools. National policymakers should revise 1+X certification standards to mandate minimum performance-based assessment requirements, establish quality assurance mechanisms for internship placements, and create employer incentive structures (tax benefits, recognition systems) that encourage substantive program participation beyond symbolic involvement.

Employers must calibrate expectations, distinguishing entry-level from senior-level competencies, and invest in structured onboarding programs that build upon foundational skills rather than expecting fully formed expertise from recent graduates. The finding that all employer expectation ratings exceeded 4.0/5.0 suggests potentially aspirational standards. Employers should also actively participate in curriculum validation, provide substantive internship opportunities involving authentic HR tasks, and recognize that 2-3-year curriculum lags necessitate workplace development investments to close gaps that pre-employment education cannot address, given current governance structures.

6.2 Limitations and Future Directions

Cross-sectional design precludes definitive causal claims. Measurement relied entirely on self-report and perceptions rather than objective performance assessments. The sample was limited to Guangdong Province and HR certification, restricting generalizability. Employer expectations may represent aspirational standards exceeding realistic entry-level requirements; all dimensions showed ratings >4.0/5.0. The study lacked non-certification comparison groups to determine whether gaps reflect 1+X inadequacies specifically or universal vocational education challenges. Qualitative sampling (n = 15) prioritized depth over breadth; larger samples might reveal additional mechanisms. Experimental designs testing specific interventions, such as performance-based assessment pilots, rapid curriculum updates, and intensive industry engagement, would strengthen causal claims. Multi-province comparisons would clarify the generalizability of Guangdong findings across manufacturing versus service economies. Studies across 1+X certificate types (logistics, e-commerce, hospitality) would reveal whether challenges are universal or domain-specific. Inclusion of non-1+X comparison groups would determine certification's incremental value. Research on predictor interactions would refine the structural model.

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Conflict of Interest

Authors declare that there is no conflict of interest regarding the publication of the manuscript.

Author Contribution

The authors confirm full responsibility for the following: study conception and design, data collection, analysis and interpretation of results, and manuscript preparation.

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