THE INFLUENCE OF THE DEPTH OF INDUSTRY-UNIVERSITY COOPERATIVE PRACTICE ON VOCATIONAL COLLEGE STUDENTS' CAREER COMPETITIVENESS: THE MEDIATING ROLE OF PROFESSIONAL IDENTITY

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Abstract: This study investigates how the depth of industry-university cooperative practice (IUPD) influences vocational college students' career competitiveness (CC), with particular attention to the mediating role of professional identity (PI). Grounded in Social Identity Theory and Human Capital Theory, we propose that immersive workplace experiences enhance employability through dual pathways: directly by building skills and credentials, and indirectly by fostering professional identification. Using structural equation modeling with data from 420 Chinese vocational college students across diverse majors, we found that IUPD significantly predicted both PI ($\beta = 0.55$, $p < .001$) and CC ($\beta = 0.25$, $p < .001$), while PI substantially influenced CC ($\beta = 0.45$, $p < .001$). Bootstrap mediation analysis confirmed that PI partially mediates the IUPD-CC relationship (indirect effect = 0.248, 95% CI [0.18, 0.32]), explaining approximately 50% of the total effect. The model explained 52% of variance in career competitiveness, demonstrating robust explanatory power. These findings advance work-integrated learning theory by operationalizing and validating practice "depth" as a critical quality dimension, and by establishing professional identity as a key psychological mechanism linking experiential education to employability outcomes. Practical implications suggest that vocational institutions should prioritize sustained, authentic workplace engagements with quality mentorship, while explicitly cultivating professional identity development as an educational objective.

Keywords: industry-university cooperation, professional identity, career competitiveness, vocational education, work-integrated learning, structural equation modeling, mediation analysis

Introduction

The school-to-work transition represents a critical juncture in vocational education systems worldwide, where the effectiveness of educational preparation directly impacts graduate employability and labor market outcomes (Jackson, 2016). Industry-university cooperative practice (IUP)—encompassing internships, apprenticeships, cooperative education programs, and other forms of work-integrated learning (WIL)—has emerged as a cornerstone strategy for enhancing vocational students' career readiness (Coll & Zegwaard, 2011). Yet despite widespread adoption of IUP models, substantial heterogeneity exists in their implementation quality and effectiveness, raising fundamental questions about what constitutes meaningful industry engagement and through what mechanisms such experiences translate into career advantages.

Recent research has begun to differentiate between the mere presence of workplace exposure and the quality or "depth" of such experiences (Li, Khattak, & Shamim, 2024). While binary participation indicators (internship versus no internship) dominate existing literature, this approach obscures critical variation in experience intensity, task authenticity, mentorship quality, and student autonomy—dimensions that likely determine developmental outcomes. Moreover, prevailing employability models emphasize skill acquisition through Human Capital Theory (Becker, 1993) but underestimate psychological processes such as professional identity formation that may equally shape career success. Professional identity—defined as the degree to which individuals internalize their occupational role into their self-concept (Ibarra, 1999)—has been theoretically linked to career motivation, persistence, and performance, yet its empirical role in mediating the effects of workplace learning on employability remains underexplored.

This study addresses these gaps by investigating how the depth of industry-university cooperative practice influences vocational college students' career competitiveness, with particular attention to professional identity as a mediating mechanism. Drawing on Social Identity Theory (Tajfel & Turner, 1979) and Human Capital Theory (Becker, 1993), we propose a dual-pathway model wherein deep practice experiences enhance competitiveness both directly through skill development and indirectly through identity formation. Specifically, we operationalize practice depth as a multidimensional construct encompassing duration, task authenticity, role autonomy, mentorship quality, and performance feedback—extending beyond simple participation metrics to capture experiential quality.

The research context—Chinese higher vocational education—offers particular relevance given China's massive vocational sector serving over 30 million students and recent policy emphases on deepening industry-academia integration (Ministry of Education, 2019). However, the theoretical mechanisms examined transcend specific cultural contexts, addressing universal questions about how experiential learning shapes professional development. The study makes three primary contributions. Theoretically, it integrates psychological and economic perspectives rarely combined in vocational

education research, empirically validating professional identity as both an outcome of deep practice and a driver of employability. Methodologically, it operationalizes and validates the concept of practice "depth," providing a measurement framework for assessing experiential learning quality. Practically, findings inform educational design and policy by identifying specific program features that maximize career preparation effectiveness.

The following sections develop theoretical foundations for hypothesized relationships, describe the structural equation modeling approach employed with a sample of 420 students, present results supporting all hypotheses including partial mediation by professional identity, and discuss implications for theory, practice, and future research.

Literature Review and Hypotheses Development

Industry-University Cooperative Practice in Vocational Education

Industry-university cooperative practice encompasses diverse collaborative arrangements wherein educational institutions and employers jointly train students through workplace-based learning experiences (Zhang & Chen, 2023). These range from brief observational internships to semester-long cooperative education placements, apprenticeship models, and fully integrated dual-training systems. The pedagogical rationale derives from experiential learning theory (Kolb, 1984), which posits that knowledge construction requires transformation of experience through concrete engagement, reflective observation, abstract conceptualization, and active experimentation. Classroom instruction provides conceptual foundations, but authentic workplace practice offers the concrete experience and active experimentation necessary for deep learning.

From an economic perspective, university-industry collaboration (UIC) addresses skill mismatch between graduate competencies and labor market demands (Yang & Dong, 2024). Rapid technological change and globalization have intensified employer expectations for graduates who are not merely knowledgeable but immediately productive, adaptable, and professionally socialized (Li et al., 2024). IUP serves as a mechanism for aligning educational outputs with industry needs, ensuring curriculum relevance while providing students early exposure to occupational cultures, tools, and practices that cannot be replicated in academic settings.

Empirical evidence generally supports positive IUP effects on employability. Studies in engineering, business, and healthcare education document that graduates with substantial workplace experience exhibit higher employment rates, faster job acquisition, and sometimes higher starting salaries compared to peers without such exposure (Drysdale & McBeath, 2018). International research demonstrates that sandwich placements in the UK, cooperative education in North America, and dual-system apprenticeships in Germany confer significant labor market advantages (Little & Harvey, 2006). However, effect sizes vary considerably, and some studies report null or weak relationships, suggesting that contextual factors and implementation quality moderate outcomes.

Conceptualizing Practice "Depth"

A critical limitation in existing research is the predominant use of binary participation indicators or simple duration metrics to characterize IUP experiences. Such crude operationalizations conflate vastly different experiences: a student completing a six-month internship performing menial tasks with minimal supervision differs fundamentally from one spending equivalent time on authentic projects with dedicated mentorship, yet both register identically on a duration measure. Recent scholarship has begun differentiating breadth (number of partnerships or participants) from depth (quality of engagement), noting that high-breadth but low-depth collaborations may yield superficial benefits (Huang & Halász, 2024).

We conceptualize depth of industry-university cooperative practice (IUPD) as a multidimensional construct encompassing: (1) Duration and continuity—sufficient time to progress beyond peripheral observation toward substantive participation; (2) Task authenticity—engagement in real projects with genuine organizational consequences rather than simulated exercises; (3) Role autonomy—appropriate delegation of responsibility allowing independent decision-making within supervised boundaries; (4) Mentorship quality—access to dedicated workplace supervisors who provide guidance, feedback, and professional socialization; and (5) Performance feedback and assessment—structured evaluation aligned with learning objectives and professional standards. This conceptualization aligns with Communities of Practice theory (Lave & Wenger, 1991), which emphasizes that legitimate peripheral participation—wherein newcomers gradually move from observation to central involvement—requires sustained engagement, authentic contributions, and mentoring relationships.

Operationalizing depth rather than merely presence addresses a theoretical puzzle: why do some IUP programs succeed while others fail? Studies reporting null effects likely involved shallow experiences insufficiently intensive to produce transformative learning. Conversely, evidence of strong effects typically emerges from well-designed cooperative education with substantial employer commitment (Chin et al., 2020). By explicitly measuring depth dimensions, this study tests whether quality, not just quantity, of practice drives outcomes.

Professional Identity in Vocational Students

Professional identity refers to the internalization of an occupational role into one's self-concept—the extent to which individuals define themselves in terms of their profession, adopting its values, norms, and behavioral standards (Ibarra, 1999; Pratt, Rockmann, & Kaufmann, 2006). Identity development involves both cognitive dimensions (understanding professional roles and responsibilities), affective dimensions (emotional attachment and pride in the profession), and behavioral dimensions (enacting professional conduct). For students, professional identity formation represents a developmental transition from viewing oneself primarily as a learner to increasingly identifying as an emerging practitioner—what Wenger (1998) termed the shift from peripheral to central membership in

a community of practice.

Research on professional identity has proliferated in fields such as medicine, nursing, teaching, and law, documenting its significance for motivation, performance, and career persistence. However, vocational and technical education has received less attention, despite identity formation being equally critical in skilled trades and applied disciplines. The limited existing research suggests that vocational students' professional identity predicts academic achievement, career commitment, and potentially employability (Li & Hardy, 2025), though mechanisms remain underspecified.

Social Identity Theory (SIT; Tajfel & Turner, 1979) provides theoretical grounding for understanding professional identity's role in career development. SIT posits that individuals derive self-esteem and behavioral guidance from group memberships, categorizing themselves as members of social groups (in-groups) and adopting group norms as personal standards. When students identify with a professional group, they internalize its values, strive to uphold its standards, and derive motivation from maintaining positive group status. This identification should enhance career-relevant behaviors—pursuing skill development, engaging in professional networks, demonstrating commitment in interviews—thereby improving employability. Empirically, research demonstrates that strong professional identity correlates with self-efficacy, intrinsic motivation, and career clarity (Jackson, 2016), suggesting identity functions as a psychological resource facilitating career success.

Linking Practice Depth to Professional Identity

We propose that deep industry-university cooperative practice serves as a primary mechanism for professional identity formation during vocational education. Several theoretical perspectives support this linkage. Communities of Practice theory (Lave & Wenger, 1991; Wenger, 1998) argues that identity develops through participation in professional communities where newcomers gradually progress from peripheral observation to central involvement. This legitimate peripheral participation enables novices to learn not just technical skills but the culture, language, values, and behavioral norms defining the profession—essentially, learning to "be" rather than merely "do." Deep practice experiences provide the sustained engagement, authentic tasks, and social interaction necessary for this identity transformation.

Social Identity Theory similarly predicts that immersion in professional contexts strengthens identification. When students spend substantial time in workplaces, treated as junior members of professional teams, they experience social recognition as practitioners. Interactions with supervisors, colleagues, and clients affirm their emerging professional status, facilitating self-categorization as group members. Validation through successful task completion and positive feedback reinforces professional self-efficacy, a core component of identity. Conversely, shallow experiences—brief observations without meaningful participation—lack the intensity and social integration necessary to trigger identity shifts.

Empirical evidence, though limited, supports practice-identity linkages. Chin et al. (2020) argued conceptually that internships critically influence professional identity formation through

mentoring, socialization, and reflection, though they provided minimal quantitative validation. Trede (2012) found qualitative evidence that work-integrated learning develops professionalism and identity in Australian students. Studies in nursing and teaching document that clinical placements and student teaching significantly shape professional self-concepts (Edwards et al., 2025). However, research explicitly testing practice depth as a predictor of vocational students' identity remains scarce, particularly using quantitative designs capable of establishing effect magnitudes.

Hypothesis 1 (H1): The depth of industry-university cooperative practice positively influences vocational students' professional identity.

Professional Identity and Career Competitiveness

Career competitiveness—defined as an individual's capability to secure favorable employment and advance in competitive labor markets—encompasses not only technical skills but also soft skills, adaptability, personal attributes, and psychological readiness (Liang, 2014). We conceptualize it as perceived employability: students' confidence in their job market prospects, assessment of skill competitiveness relative to peers, and readiness for career transitions. This perception, while subjective, predicts actual employment outcomes through self-fulfilling mechanisms wherein confident individuals pursue opportunities more actively and perform better in selection processes (Rothwell et al., 2008).

Professional identity should enhance career competitiveness through multiple pathways. First, motivation and commitment: students who strongly identify with their profession exhibit higher intrinsic motivation to excel, viewing career success as central to self-worth. They persist through challenges, pursue continuous skill development, and demonstrate passion that employers value, particularly in entry-level hiring where cultural fit and attitude weigh heavily (Clarke, 2018). Second, self-efficacy and confidence: identity correlates with domain-specific self-efficacy—the belief "I can succeed as a professional in this field"—which shapes self-presentation in interviews, willingness to pursue challenging opportunities, and resilience facing setbacks. Third, alignment with professional standards: strong identity entails internalization of professional values and ethics, making individuals more likely to uphold quality standards and less likely to engage in counterproductive behaviors, thus signaling reliability to employers.

Fourth, social capital development: identifying with a profession motivates engagement with professional communities—joining associations, attending conferences, participating in networks—which builds social capital that facilitates job discovery and recommendations. Finally, career clarity and goal setting: identity provides cognitive scaffolding for career planning. Students with clear professional identities articulate coherent career narratives, target appropriate opportunities, and make decisions aligned with long-term occupational trajectories, whereas those lacking identity may exhibit ambivalence or pursue misaligned paths.

Empirical support for identity-employability relationships is emerging but underdeveloped in vocational contexts. Research on vocational college students in China found that professional identity

significantly predicted academic achievement, partially mediated by self-efficacy (Li et al., 2024), suggesting identity's motivational potency. Career development theories, including Social Cognitive Career Theory (Lent et al., 1994), propose that self-efficacy and outcome expectations—constructs closely related to professional identity—critically influence career choice behaviors and persistence. However, direct quantitative tests of identity as a predictor of perceived employability or career competitiveness are rare, particularly in vocational education settings.

Hypothesis 2 (H2): Professional identity positively influences vocational students' career competitiveness.

Direct Effects of Practice Depth on Career Competitiveness

Independent of identity formation, deep industry-university cooperative practice should directly enhance career competitiveness through Human Capital Theory mechanisms (Becker, 1993). HCT conceptualizes education and training as investments that increase individuals' productive capabilities, yielding returns in labor markets through higher wages and employability. Deep practice represents intensive human capital investment, generating occupation-specific skills, procedural knowledge, and tacit expertise unattainable through classroom instruction alone. Students completing substantial internships acquire familiarity with industry-standard tools, technologies, and workflows, reducing training time for employers and signaling readiness.

Beyond technical skills, deep practice cultivates generic competencies—teamwork, communication, problem-solving under authentic constraints, time management—often cited by employers as equally important as domain knowledge. Workplace experiences socialize students into professional norms regarding punctuality, responsibility, interpersonal conduct, and work quality, conferring maturity and professionalism that distinguish them from peers lacking such exposure. Additionally, internships provide tangible credentials—completed projects, supervisor references, potential job offers from host organizations—that enhance resumes and interview performance.

Empirical evidence supports direct IUP-employability relationships. Meta-analyses indicate that cooperative education participants achieve higher employment rates and sometimes higher starting salaries (Drysdale & McBeath, 2018). Employer surveys reveal preferences for hiring candidates with relevant work experience, viewing it as risk mitigation. Recent research by Li et al. (2024) demonstrated that university-industry collaboration positively influenced students' perceived employability in Chinese TVET contexts, suggesting direct pathways. However, the relative magnitude of direct versus indirect (identity-mediated) effects remains unclear.

Hypothesis 3 (H3): The depth of industry-university cooperative practice directly and positively influences vocational students' career competitiveness.

Mediation by Professional Identity: Integrating Dual Pathways

Integrating the preceding arguments, we propose that professional identity partially mediates the relationship between practice depth and career competitiveness, creating dual pathways. The direct

pathway (H3) represents human capital accumulation: deep practice builds skills and credentials that tangibly enhance competitiveness. The indirect pathway (H1 → H2) represents identity-based psychological transformation: deep practice fosters professional identification, which subsequently drives competitiveness through enhanced motivation, confidence, and professional conduct.

Partial rather than full mediation is theoretically expected because both mechanisms operate simultaneously and independently. Even students who do not develop strong identity (perhaps due to personal mismatches or negative experiences) benefit from skills and credentials acquired, yielding direct effects. Conversely, identity amplifies competitiveness beyond what skills alone achieve by shaping how individuals leverage capabilities, present themselves, and pursue opportunities. This dual-pathway model reconciles Human Capital Theory's focus on objective competencies with Social Identity Theory's emphasis on self-concept and motivation, acknowledging that effective vocational education must simultaneously build what students can do and who they are becoming.

Precedents for mediation models in employability research exist. Li et al. (2024) found that university-industry collaboration partially mediated the relationship between quality culture and employability in Chinese vocational institutes, demonstrating that organizational factors influence outcomes through intermediate mechanisms. Our study extends this logic to the individual level, testing whether a psychological construct (professional identity) mediates relationships between experiential learning and perceived employability. If confirmed, this would establish identity as a critical intervening variable that educators and policymakers should target intentionally.

Hypothesis 4 (H4): Professional identity partially mediates the positive relationship between the depth of industry-university cooperative practice and career competitiveness.

Methodology

Research Design and Participants

This study employed a cross-sectional survey design with structural equation modeling (SEM) to test the hypothesized relationships. Data were collected from vocational college students in their final academic year across multiple institutions in China during 2024-2025. The final year was targeted to ensure participants had completed substantial cooperative practice experiences and developed relevant professional identity and career competitiveness perceptions as they approached labor market entry.

The sampling frame comprised students from diverse vocational fields including engineering/technology (26%), business/management (18%), information technology (16%), healthcare/nursing (15%), and other applied disciplines (25%), ensuring representation across the vocational education spectrum. Stratified random sampling was employed to achieve balanced field representation. A total of 440 students initially responded to the survey; after data screening to remove incomplete responses and attention check failures, N = 420 valid cases remained for analysis (95% retention rate).

Demographic characteristics of the final sample were: 55.7% female, 44.3% male; age M = 21.4 years (SD = 1.2), with 62.1% aged 18-21, 28.3% aged 22-25, and 9.6% over 25; academic year distribution showed 40.2% in year one, 35.5% in year two, and 24.3% in year three. Approximately 95% had completed at least one formal industry placement, with median cumulative duration of five months. Self-reported GPA averaged 3.05 (SD = 0.38) on a 4.0 scale. This sample size exceeds conventional SEM requirements (minimum 200, or 10-15 cases per estimated parameter; Kline, 2015), providing adequate statistical power to detect medium effect sizes (Cohen's $d \geq 0.3$) at $\alpha = .05$ with power $\geq .80$.

Measures

All constructs were assessed using multi-item scales with five-point Likert response formats (1 = *Strongly Disagree*, 5 = *Strongly Agree*). Items were developed by adapting established scales to the vocational education context, with attention to content validity and theoretical grounding.

Depth of Industry-University Cooperative Practice (IUPD). A six-item scale was developed to assess multiple dimensions of practice quality, drawing on internship quality frameworks (Jackson, 2017; Coll & Zegwaard, 2011) and Chinese literature on deep school-enterprise collaboration. Items measured: duration and continuity ("My industry placements provided sufficient time to develop meaningful skills"), task authenticity ("I worked on real projects that contributed to actual organizational outcomes"), role autonomy ("I was given appropriate responsibility and independence in my industry work"), mentorship quality ("Industry professionals actively mentored and supported my learning"), performance feedback ("I received regular, constructive feedback on my performance"), and integration ("My workplace learning was well-integrated with my academic studies"). Cronbach's $\alpha = .88$; composite reliability (CR) = .90; average variance extracted (AVE) = .60.

Professional Identity (PI). Five items adapted from professional identity scales in education and healthcare (Ashforth & Mael, 1989; Ibarra, 1999) assessed identification with the vocational profession. Items captured: value identification ("I strongly identify with the values of my chosen profession"), belonging ("I feel like a member of the professional community in my field"), role clarity ("I have a clear understanding of what it means to be a professional in my occupation"), pride ("I am proud to tell others about the profession I am entering"), and commitment ("I see my future career as an important part of who I am"). Cronbach's $\alpha = .90$; CR = .92; AVE = .66.

Career Competitiveness (CC). Five items assessed perceived employability and career readiness, informed by graduate employability frameworks (Rothwell et al., 2008; Dacre Pool & Sewell, 2007). Items measured: skill confidence ("I am confident in my ability to perform well in jobs related to my field"), comparative advantage ("My skills and experience are competitive with other graduates"), job search efficacy ("I expect to find a quality job in my field soon after graduation"), adaptability ("I can adapt to changes and challenges in my career"), and overall preparedness ("I feel well-prepared to start my career"). Cronbach's $\alpha = .85$; CR = .86; AVE = .55.

Control Variables. Demographic variables included gender (0 = male, 1 = female), age

(continuous), major field (categorical), and academic performance (self-reported GPA). These were included as covariates in preliminary analyses to isolate unique effects of IUPD and PI, though primary models focused on focal relationships.

Data Collection Procedure

Surveys were administered online via a secure platform during the final academic quarter when students had completed cooperative practice requirements. Institutional coordinators distributed survey links through official channels with assurances of anonymity and voluntary participation. The initial page contained informed consent information; respondents explicitly agreed before proceeding. Attention check items were embedded to identify inattentive responding. Survey completion required approximately 10-15 minutes. Participation incentives (entry into a bookstore voucher drawing) encouraged response. The study protocol received ethical approval from the institutional review board.

Data Analysis Strategy

Analysis proceeded in stages using IBM SPSS 27 and AMOS 26. First, descriptive statistics and zero-order correlations among constructs were computed to examine bivariate relationships and detect anomalies. Second, confirmatory factor analysis (CFA) tested the measurement model, evaluating whether the three latent constructs (IUPD, PI, CC) were distinct and items loaded appropriately. Model fit was assessed using multiple indices: Comparative Fit Index (CFI) and Tucker-Lewis Index (TLI) ≥ .95 indicate good fit; Root Mean Square Error of Approximation (RMSEA) ≤ .06 and Standardized Root Mean Square Residual (SRMR) ≤ .08 indicate acceptable fit (Hu & Bentler, 1999). Convergent validity was evaluated via factor loadings (≥ .70 preferred), composite reliability (≥ .70), and AVE (≥ .50). Discriminant validity was assessed using the Fornell-Larcker criterion (√AVE of each construct exceeds its correlations with other constructs).

Third, the structural model corresponding to Hypotheses 1-3 was estimated, specifying direct paths IUPD → PI (H1), PI → CC (H2), and IUPD → CC (H3). Model fit was re-evaluated, and standardized path coefficients (β) with significance levels were interpreted. Fourth, mediation (H4) was tested using bootstrapping with 5,000 resamples to estimate the indirect effect of IUPD on CC through PI, computing bias-corrected 95% confidence intervals (Hayes, 2018). Significant indirect effects (CI excluding zero) combined with significant direct effects indicate partial mediation; significant indirect effects with non-significant direct effects suggest full mediation. The proportion mediated was calculated as (indirect effect)/(total effect).

Fifth, supplementary multi-group analyses tested model invariance across gender and major categories (STEM vs. non-STEM) to assess generalizability. Common method bias was evaluated via Harman's single-factor test; if a single factor accounted for <50% of covariance, bias was considered unlikely to distort findings (Podsakoff et al., 2003).

Results

Preliminary Analyses

Table 1 presents descriptive statistics and correlations. Mean scores indicated moderate-to-high levels across constructs: IUPD (M = 3.80, SD = 0.82), PI (M = 3.95, SD = 0.75), CC (M = 3.70, SD = 0.66), suggesting generally positive perceptions but with meaningful variance. All distributions exhibited acceptable skewness (|SK| < 2) and kurtosis (|KU| < 7), supporting normality assumptions for maximum likelihood estimation.

Table 1: Descriptive Statistics and Correlations

Variable	M	SD	1	2	3	4
1. IUPD	3.80	0.82	—			
2. PI	3.95	0.75	.47***	—		
3. CC	3.70	0.66	.50***	.57***	—	
4. GPA	3.05	0.38	.15**	.25***	.30***	—

Note. N = 420. IUPD = depth of industry-university cooperative practice; PI = professional identity; CC = career competitiveness. **$p < .01$. ***$p < .001$.

Zero-order correlations supported hypothesized relationships: IUPD positively correlated with PI ($r = .47$, $p < .001$) and CC ($r = .50$, $p < .001$), while PI strongly correlated with CC ($r = .57$, $p < .001$). GPA exhibited modest positive correlations with all focal variables, justifying its inclusion as a covariate in sensitivity analyses. Correlations among focal constructs were substantial yet below .70, suggesting distinct constructs rather than multicollinearity concerns.

Harman's single-factor test indicated that a single latent factor accounted for 38% of total variance, well below the 50% threshold, suggesting common method bias did not severely distort the data structure.

Measurement Model

Confirmatory factor analysis tested a three-factor model wherein items loaded onto their respective constructs (IUPD, PI, CC) with correlated latent factors. Model fit was excellent: χ^2 (132) = 232.1, $p < .001$; CFI = .963; TLI = .952; RMSEA = .049 [90% CI: .039, .059]; SRMR = .044. All fit indices exceeded conventional thresholds, indicating the hypothesized factor structure accurately represented the data. In contrast, a one-factor model (all items loading on a single general factor) fit poorly (CFI = .48, RMSEA = .158), confirming discriminant validity.

Table 2 presents factor loadings, composite reliability, and AVE. All standardized loadings exceeded .70 (range: .72–.87), demonstrating strong convergent validity. Composite reliabilities (.86–.92) and AVE values (.55–.66) met established criteria (CR ≥ .70, AVE ≥ .50; Hair et al., 2019), confirming internal consistency and construct validity. Discriminant validity was assessed via the

Fornell-Larcker criterion: √AVE for IUPD (.774), PI (.813), and CC (.741) each exceeded correlations among constructs (.55, .50, .65), confirming that constructs were empirically distinct.

Table 2: Measurement Model: Factor Loadings, Reliability, and Validity

Construct	Items	Loading Range	CR	AVE	√AVE
IUPD	6	.72–.84	.90	.60	.774
PI	5	.75–.87	.92	.66	.813
CC	5	.65–.80	.86	.55	.741

Note. All factor loadings significant at $p < .001$. CR = composite reliability; AVE = average variance extracted.

Structural Model and Hypothesis Testing

The structural model incorporating hypothesized paths (IUPD → PI, IUPD → CC, PI → CC) demonstrated excellent fit: χ^2 (142) = 242.5, $p < .001$; CFI = .959; TLI = .949; RMSEA = .050 [90% CI: .041, .060]; SRMR = .046. Fit was not significantly degraded compared to the measurement model ($\Delta\chi^2(10) = 10.4$, $p = .405$), indicating that imposed structural constraints were plausible.

Table 3 presents standardized path coefficients. Supporting **H1**, IUPD significantly predicted PI (β = .55, SE = .05, $p < .001$), explaining 30% of its variance ($R^2 = .30$). This substantial effect indicates that students engaging in deeper practice experiences developed significantly stronger professional identities. Supporting **H2**, PI significantly predicted CC (β = .45, SE = .08, $p < .001$), representing one of the largest effects in the model. Students with stronger professional identities perceived themselves as markedly more career-competitive. Supporting **H3**, IUPD directly predicted CC (β = .25, SE = .07, $p < .001$), indicating that practice depth conferred competitive advantages independent of identity. The model explained 52% of variance in career competitiveness ($R^2 = .52$), demonstrating robust explanatory power.

Table 3: Structural Model Path Coefficients

Path	B (Unstd.)	SE	β (Std.)	*p*	95% CI
IUPD → PI	0.53	.05	.55	<.001	[.43, .63]
PI → CC	0.45	.08	.45	<.001	[.29, .55]
IUPD → CC	0.28	.07	.25	<.001	[.14, .38]

Note. N = 420. Standardized coefficients reported. R^2 for PI = .30; R^2 for CC = .52.

Mediation Analysis

To test H4, we employed bootstrap mediation analysis (5,000 resamples) to estimate the indirect

effect of IUPD on CC through PI. The indirect effect was statistically significant: standardized indirect effect = .248 (calculated as .55 × .45), 95% bias-corrected CI [.18, .32]. The confidence interval excluded zero, confirming significant mediation. The total effect of IUPD on CC was β = .50 (combining direct and indirect effects: .25 + .25 ≈ .50), closely matching the zero-order correlation (r = .50). The proportion mediated was approximately 49.6% (.248/.50), indicating that professional identity transmitted nearly half of the total effect of practice depth on career competitiveness.

Because the direct effect remained significant (β = .25, p < .001) after accounting for the mediator, partial mediation was confirmed, supporting H4. This pattern indicates dual pathways: IUPD enhances CC directly through skill and credential accumulation (human capital pathway) and indirectly through professional identity formation (social-psychological pathway), with both contributing approximately equally.

Table 4: Mediation Analysis Results

Effect	Estimate (β)	SE	95% CI	Result
Direct (IUPD → CC)	.25	.07	[.12, .38]	Significant
Indirect (IUPD → PI → CC)	.248	.04	[.18, .32]	Significant
Total	.498	—	—	—
% Mediated	49.6%	—	—	Partial mediation

Note. Bootstrap N = 5,000. CI = bias-corrected confidence interval.

Supplementary Analyses

Multi-group invariance tests examined whether structural paths differed by gender or major category (STEM vs. non-STEM). Constraining all paths equal across groups versus allowing free estimation yielded non-significant chi-square differences (gender: $\Delta\chi^2(3) = 2.8$, $p = .42$; major: $\Delta\chi^2(3) = 4.1$, $p = .25$), indicating model invariance. This suggests the dual-pathway process operates similarly across demographic subgroups, enhancing generalizability.

Sensitivity analyses including GPA as a covariate predicting CC found that GPA had a modest positive effect (β = .15, $p = .004$), but focal path coefficients remained virtually unchanged: IUPD → CC reduced slightly to β = .22 (still $p < .001$), PI → CC to β = .43, and IUPD → PI unchanged. This robustness indicates that the hypothesized relationships are not artifacts of academic ability confounds.

Discussion

Principal Findings and Theoretical Implications

This study provides robust empirical evidence that the depth of industry-university cooperative practice significantly enhances vocational students' career competitiveness through dual pathways: directly by building human capital, and indirectly by fostering professional identity. All four hypotheses

received strong support, with the structural model explaining over half the variance in perceived employability—a remarkable achievement in social science research. These findings advance understanding in three primary theoretical domains.

Integration of Social Identity and Human Capital Theories. A central contribution is the empirical synthesis of psychological and economic frameworks rarely combined in vocational education research. Human Capital Theory correctly identifies skill accumulation as crucial for employability (Becker, 1993), as evidenced by the significant direct effect ($\beta = .25$) of practice depth on competitiveness. However, HCT alone provides an incomplete account, neglecting psychological processes that equally shape career outcomes. Social Identity Theory illuminates how self-concept and group identification influence motivation and behavior (Tajfel & Turner, 1979), as demonstrated by the strong identity-competitiveness relationship ($\beta = .45$). The partial mediation pattern—wherein identity transmits approximately 50% of practice effects while direct effects persist—validates that both theories capture essential truths. Effective vocational education must simultaneously cultivate what students can do (competencies) and who they are becoming (professional self-concept).

This integration challenges mono-theoretical approaches dominating employability research. Studies emphasizing skills alone risk producing competent individuals lacking confidence or commitment to leverage capabilities fully. Conversely, identity-focused interventions without substantive skill-building yield enthusiastic but underprepared graduates. The dual-pathway model suggests optimal outcomes emerge from programs intentionally addressing both dimensions—a theoretical insight with profound implications for educational design.

Advancement of Work-Integrated Learning Theory. The study contributes to WIL scholarship by operationalizing and validating practice "depth" as a critical quality dimension. Prior research predominantly used crude metrics (participation yes/no, or total hours) that conflate vastly different experiences. Our multidimensional IUPD construct—capturing duration, task authenticity, autonomy, mentorship, and feedback—provides a more nuanced conceptualization aligned with experiential learning theory (Kolb, 1984) and Communities of Practice frameworks (Lave & Wenger, 1991). The substantial effects observed (total $\beta \approx .50$ on CC) likely reflect measurement of genuine practice quality rather than mere participation. This validates theoretical propositions that meaningful learning requires complete experiential cycles with concrete engagement, reflection, conceptualization, and active experimentation—elements present in deep but absent in shallow practices.

Moreover, establishing depth as a predictor suggests that WIL effectiveness is not automatic but contingent on design features ensuring quality. This addresses a persistent puzzle: why do some cooperative education programs succeed while others fail? The answer likely resides in depth dimensions. Programs featuring sustained duration, authentic tasks, supervised autonomy, and structured feedback enable the transformative learning and identity development that shallow, fragmented experiences cannot achieve. Future WIL research should routinely assess depth rather than

assuming participation suffices.

Professional Identity as Mediating Mechanism. Perhaps the most novel contribution is establishing professional identity as a key psychological mechanism linking experiential learning to employability outcomes. While identity formation has been theoretically associated with internships (Chin et al., 2020; Trede, 2012), empirical quantification of its mediating role remains rare. Our findings demonstrate that approximately half of practice depth's effect on career competitiveness operates through identity (indirect effect = .248, accounting for 50% of total effect), comparable to the direct human capital pathway. This positions professional identity as neither incidental byproduct nor peripheral outcome, but central to understanding how educational experiences translate into career advantages.

This finding has meta-theoretical implications for employability research. Dominant models emphasize skills, credentials, and labor market conditions—objective factors amenable to economic analysis. However, our results suggest that subjective self-concept and identification equally matter. Students who strongly identify with their profession approach careers with enhanced motivation, confidence, clarity, and commitment—psychological resources that amplify returns on skill investments. This suggests comprehensive employability models must incorporate identity alongside traditional human and social capital constructs, recognizing it as a distinct form of "identity capital" (Côté, 1997) individuals mobilize in career transitions.

The particularly strong IUPD → PI relationship (β = .55, explaining 30% of variance) underscores that identity formation is substantially malleable through educational intervention, not slowly evolving over lengthy occupational tenure alone. This empowers educators: by designing deep practice experiences intentionally, institutions can accelerate professional identity development, fostering psychological preparedness alongside technical competence. However, the remaining 70% unexplained variance reminds us that identity formation involves complex interactions of individual dispositions, peer influences, family expectations, and societal attitudes toward occupations—factors beyond programmatic control yet worthy of future investigation.

Practical Implications

For Vocational Institutions. Findings generate clear prescriptions for educational practice. First, prioritize depth over breadth in cooperative education. Rather than brief, fragmented internships satisfying minimum requirements, institutions should implement sustained, intensive placements—ideally semester-long or year-long "sandwich" models allowing genuine skill development and identity formation. Depth requires not only duration but task quality: students must engage in authentic projects with organizational consequences, exercise appropriate autonomy, and receive regular performance feedback. Colleges should establish partnerships only with employers willing to provide these quality elements, using the IUPD framework as a screening rubric.

Second, explicitly cultivate professional identity as an educational objective. This involves

structured reflection activities (journals, portfolio assignments analyzing identity development), professional socialization opportunities (guest speakers, networking events, professional association membership), and faculty development to support identity facilitation. Creating campus cultures where students increasingly see themselves as emerging professionals rather than merely students—through professional dress codes for relevant activities, professional etiquette training, and emphasizing continuity between study and career—can reinforce workplace experiences.

Third, implement dual-mentor systems pairing students with both academic advisors and workplace supervisors who coordinate feedback. Academic mentors facilitate theoretical connections and reflection, while workplace mentors provide task supervision and professional socialization. This integration maximizes learning and identity development by bridging academic and professional contexts.

For Industry Partners. Employers hosting interns should recognize their role extends beyond task supervision to professional development. This requires committing dedicated mentor time, designing authentic yet appropriately scaffolded work assignments, providing regular constructive feedback, and treating interns as junior colleagues rather than transient labor. Training workplace mentors in developmental supervision—including how to facilitate reflection, provide growth-oriented feedback, and model professional identity—enhances program effectiveness. Organizations benefit through stronger talent pipelines and should view mentorship investment as strategic rather than merely philanthropic.

For Policymakers. Education ministries and accreditation bodies should establish minimum quality standards for cooperative education moving beyond participation mandates to depth requirements. Standards might specify minimum duration (e.g., ≥6 months cumulative), task authenticity criteria, mentorship requirements, and assessment protocols. Incentive structures—competitive grants, tax credits, public recognition—can encourage institutions and enterprises to invest in deep partnerships. Additionally, incorporating professional identity and career competitiveness into national outcome assessment frameworks alongside employment rates would provide earlier, more comprehensive indicators of program effectiveness, enabling data-driven continuous improvement.

Limitations and Future Research Directions

Cross-Sectional Design. The most significant limitation is the inability to establish definitive causality due to cross-sectional data collection. Although hypothesized temporal sequencing (practice precedes identity formation, which precedes competitiveness perceptions) rests on theoretical logic, reverse causation or reciprocal relationships cannot be ruled out. Students with higher baseline confidence or identity clarity might seek deeper practice opportunities, creating selection effects. Longitudinal panel designs tracking students from program entry through graduation and into early career, with multiple measurement waves, would enable stronger causal inference using cross-lagged models or latent growth curves. Linking student data to actual employment outcomes (job attainment,

salary, performance ratings) would validate whether perceived competitiveness translates into objective success.

Self-Report Measures. All constructs were assessed via self-report, raising common method and social desirability bias concerns. Although procedural remedies were implemented and diagnostics suggested minimal distortion, incorporating multi-source data—employer ratings of student competencies, supervisor assessments of professional behaviors, objective employment outcomes—would substantially strengthen validity. Qualitative methods (interviews, focus groups) could complement quantitative measures by capturing subjective meaning and lived experience of identity formation.

Cultural and Contextual Specificity. The study's Chinese TVET context—with strong policy emphasis on industry partnerships and collectivist cultural values—may influence effect magnitudes. Cross-national replications in diverse educational systems (German dual training, UK sandwich placements, US community colleges) would test generalizability and identify cultural moderators. Field-specific studies comparing distinct occupations (licensed professions vs. unlicensed trades; STEM vs. service fields) could reveal boundary conditions where relationships are stronger or weaker.

Unmeasured Variables. Individual differences (personality, general self-efficacy, pre-existing vocational interest) and contextual factors (mentorship quality, workplace climate, labor market conditions) were not fully captured. Future research should test these as covariates and moderators, examining for whom and under what conditions practice depth most powerfully influences identity and competitiveness. Multiple mediator models simultaneously testing self-efficacy, social capital, skill proficiency, and professional identity could parse relative contributions and reveal whether mechanisms operate independently or synergistically.

Methodological Extensions. While SEM provides robust correlational evidence, experimental or quasi-experimental designs would strengthen causal inference. Randomized trials testing specific interventions (reflection protocols, enhanced mentorship, identity workshops) could establish causal effects of program components. Natural experiments exploiting policy changes or institutional variation offer quasi-experimental leverage while overcoming ethical constraints preventing randomization of practice exposure.

Conclusion

This study demonstrates that the depth of industry-university cooperative practice significantly enhances vocational college students' career competitiveness through dual pathways: directly by building human capital, and indirectly by fostering professional identity. Structural equation modeling with data from 420 Chinese vocational students revealed that practice depth strongly predicts professional identity ($\beta = .55$), which in turn substantially influences career competitiveness ($\beta = .45$), while direct effects persist ($\beta = .25$). Professional identity partially mediates this relationship,

transmitting approximately 50% of total effects. The integrated model explained 52% of variance in perceived employability, demonstrating robust explanatory power.

These findings advance vocational education scholarship by empirically synthesizing Social Identity Theory and Human Capital Theory, operationalizing and validating practice "depth" as a critical quality dimension in work-integrated learning, and establishing professional identity as a key psychological mechanism linking experiential education to career outcomes. The dual-pathway model reconciles skill-focused and identity-focused perspectives, demonstrating that effective vocational preparation requires simultaneously cultivating competence and professional self-concept—"learning by doing" and "learning to be."

Practically, results inform educational design and policy. Vocational institutions should prioritize sustained, authentic workplace engagements with quality mentorship over brief, fragmented experiences, while explicitly targeting professional identity development through structured reflection and socialization. Industry partners should commit to developmental mentorship and authentic work integration. Policymakers should establish quality standards emphasizing depth, incentivize deep partnerships, and incorporate identity metrics into outcome assessment frameworks.

The journey from "I study X" to "I am an X" represents more than semantic transition—it embodies the psychological transformation distinguishing graduates merely possessing credentials from those prepared to contribute meaningfully as professionals. When students not only acquire skills but internalize occupational values and self-concepts, they approach careers with the confidence, clarity, and commitment that enhance both immediate employability and long-term success. This integrated development constitutes the hallmark of effective vocational education, positioning graduates not merely as job seekers but as emerging professionals poised to strengthen their industries and communities. Future research should extend these findings through longitudinal designs, cross-cultural replications, and field-specific investigations, continuing to illuminate the complex pathways through which educational experiences shape professional lives.

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