COLLABORATIVE MANAGEMENT MODEL FOR TEACHERS OF SINO-GERMAN EDUCATIONAL COOPERATION AT HIGHER EDUCATION INSTITUTIONS IN GUIZHOU PROVINCE, CHINA

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Received 27 August 2025

Revised 21 September 2025

Accepted 4 October 2025

Abstract

This study investigates the teacher collaborative management model in Sino-German educational partnerships across 12 higher education institutions in Guizhou Province, China, a region with growing internationalization needs but limited cross-cultural collaboration experience, against the backdrop of over 40 years of bilateral vocational education cooperation and initiatives such as the Sino-German Advanced Vocational Education Cooperation Project (SGAVE). A mixed-methods approach was employed. A quantitatively validated questionnaire (Cronbach's α: 0.900–0.922; CR: 0.87–0.92; AVE: 0.64–0.74) was distributed to 580 stakeholders (including subject teachers, language instructors, dual-system supervisors, and administrators), with 512 valid responses retained. Confirmatory factor analysis (CFA) was used, as the constructs were theory-derived. Qualitatively, semi-structured interviews were conducted with nine Chinese and German experts in cross-cultural collaboration and internationalization at HEIs (including vocational education). The study developed a conceptual framework incorporating eight latent variables: Conflict Resolution, Workforce Diversity, Cross-Cultural Competence, Emotional Intelligence, Social Competence, Knowledge Management Competence, Power Distance, and Trust Level. All constructs significantly positively influenced collaborative management effectiveness (standardized coefficients: 0.74–0.85; $p < 0.001$). Practical implications include enhancing cross-cultural training, establishing knowledge management platforms, and optimizing power distance dynamics to support sustainable Sino–German higher vocational education cooperation in developing regions.

Keywords: Sino-German Educational Cooperation, Collaborative Management, Higher Vocational Education, Guizhou Province.

Introduction

Since 1978, Sino-German vocational education cooperation has evolved through phases of introduction, migration, and innovation. It has facilitated the transfer of knowledge regarding industry-education integration, school-enterprise collaboration, and work-based learning in China. Key developments include the 1985 pilot of the dual-system model in six cities, the establishment of the Research Institute of Vocational and Technical Education in 1990, and the founding of applied technology universities such as Tongji University's Sino-German Engineering College in 2004 and Tianjin Sino-German Applied Technology University in 2015. Alignment between Germany's Industry 4.0 and China's Made in China 2025 strategy has further intensified cooperation. In 2021, the Sino-German Advanced Vocational Education Cooperation Project (SGAVE) was launched, expanding collaboration through joint programs, curriculum development, and institutional exchanges. These efforts have advanced the internationalization of China's higher vocational education system, where vocational curricula are integrated into higher education institutions to cultivate application-oriented talent.

It is important to note that most countries have their own distinct educational systems, and China's higher education system possesses unique characteristics that differ from those of mainstream educational models in many countries. For example, higher vocational colleges, commonly referred to as higher vocational colleges or junior colleges (in Chinese: Da Zhuan), are classified as part of the higher education system, despite not having degree-granting authority. In contrast, many countries do not include an equivalent category within their higher education systems. When translating "Da Zhuan" into English, the term "vocational college" is commonly used, which in most countries falls under vocational training rather than higher education. Sino-German vocational education cooperation occurs primarily between Chinese and German universities, as well as between Chinese higher vocational colleges and German Universities of Applied Sciences. Since all these entities are recognized as higher education institutions within their respective cooperative frameworks, this study uniformly uses the term Higher Education Institutions (HEIs) to describe the institutional context of the collaboration.

The 2024 VET Data Report by Germany's Federal Institute for Vocational Education and Training notes growing global interest in German vocational education, with its international cooperation office handling 450 inquiries from 67 countries. Sino-German collaboration remains central to this engagement, with 1,308 university partnerships recorded, including 521 in applied sciences, involving 211 German and 372 Chinese institutions. However, internationalization must account for systemic differences between countries. Despite long-term cooperation, the adoption of Germany's dual-system model in China faces challenges such as divergent social and educational systems, incomplete legal frameworks, and uneven recognition of vocational training. At the institutional level, administrative disparities, resource imbalances, and cultural differences inhibit engagement among educators, students, and

managers. Thus, effective collaborative management is essential for navigating these complexities.

Existing research treats Sino-German vocational education cooperation as a form of transnational collaboration shaped by cultural and internationalization dynamics. However, studies remain largely comparative, focusing on cooperation models, system reform, and internationalization impacts, while paying limited attention to institutional-level collaborative management between Chinese and German higher education institutions. Little is known about stakeholder interactions, especially faculty competencies in conflict resolution, cross-cultural communication, and knowledge management within collaborative environments.

Guizhou Province, a developing region in southwestern China, is promoting internationalization through initiatives such as the Belt and Road Initiative and big data pilot zones. Although twelve of its higher education institutions participate in the SGAVE project, their outcomes remain less effective than those of eastern coastal regions. This gap is associated with limited international capacity, underdeveloped collaborative management systems, and insufficient faculty readiness for cross-cultural work.

In this context, this study aims todevelop a conceptual framework for teacher collaborative management in Sino-German educational cooperation in Guizhou's higher education institutions; empirically validate the framework using mixed methods to test the effect of key variables on collaborative management effectiveness; and propose practical measures to enhance sustainable Sino-German higher vocational education cooperation in developing regions.

Literature Review

Collaborative Management

Theoretical foundations of collaboration trace back to Max Weber's bureaucratic theory (1922) and Durkheim's social division of labor concept (1893), which established the interdependence between organizational and societal actors. Chester Barnard (1938) later conceptualized organizations as collaborative systems in The Functions of the Executive, positioning cooperation as central to goal attainment. Contemporary scholarship has expanded these principles: Ansell & Gash (2008) developed a collaborative governance framework addressing multi-stakeholder engagement, while Sullivan (2022) created a four-domain analytical model (political, material, cultural, spatial) for cross-boundary collective action.

In international education research, Altbach & Knight (2007) identified collaboration as pivotal for global higher education development, a perspective reinforced by Adekunle et al. (2023) through their work on the role of cross-cultural educational collaboration in fostering global citizenship. James et al. (2007) proposed a tripartite model of collaborative practice,

where collaboration, reflective practice, and task focus interact dynamically—a framework particularly applicable to institutional studies. Dietrich et al. (2010) further systematized these concepts through a meta-analysis of collaboration antecedents, demonstrating their consistent positive correlation with project success.

Key Components of the Collaborative Management Model of Teachers in Sino-German Higher Education Cooperation at HEIs in Guizhou Province

The collaborative management model for teachers in Sino-German higher education cooperation at Guizhou's HEIs integrates eight core components: conflict resolution, workforce diversity, cross-cultural competence, emotional intelligence, social competence, knowledge management competence, power distance, and trust level. These components are systematically selected based on their theoretical foundations, relevance to cross-cultural challenges, and contribution to collaborative effectiveness.

Conflict Resolution

Rooted in Thomas & Kilmann's Conflict Mode Instrument (TKI) (1974/2012), this component addresses inevitable disputes in collaborative activities, such as disagreements over curriculum design or teaching schedules. Effective conflict resolution prevents operational disruptions and sustains collaborative momentum.

Workforce Diversity

Based on Milliken & Martins' Workforce Diversity Model (1996), this component leverages varied backgrounds, expertise, and cultural perspectives of Chinese and German teachers. Managing diversity enhances innovation and prevents friction caused by role ambiguity or divergent professional practices.

Cross-Cultural Competence

Informed by Hofstede's Cultural Dimension Theory (1980, 2010) and Sullivan's Collaboration Analysis Framework (2022), this component enables teachers to navigate differences in educational philosophies, communication styles, and pedagogical expectations between Sino-German contexts.

Emotional Intelligence

Drawing from Mayer & Salovey's Emotional Intelligence Theory (1997) and Goleman's Mixed Model (1995), this component supports teachers in recognizing, regulating, and responding to emotions—both their own and those of collaborators—which is critical for maintaining interpersonal harmony in cross-cultural settings.

Social Competence

Guided by Rose-Krasnor's Social Competence Theory (1997), this component emphasizes skills in building relationships, facilitating communication, and fostering mutual understanding, all essential for coordinating tasks and sustaining team cohesion.

Knowledge Management Competence

Grounded in Nonaka & Takeuchi's SECI Model (1995) and Fischer's Knowledge Management Process Theory (2020), this component enables the systematic sharing, integration, and co-creation of knowledge—such as adapting German dual-system expertise to Chinese institutional contexts—thereby enhancing collective learning and value creation.

Power Distance

Also derived from Hofstede's cultural dimensions, this component addresses differences in hierarchical expectations and decision-making styles between Chinese and German educational systems. Managing power distance ensures balanced participation and mitigates conflicts arising from authority perceptions.

Trust Level

As a foundational element in Ansell & Gash's Collaborative Governance Framework (2008), trust level determines the willingness of teachers to share knowledge, commit to common goals, and rely on each other's expertise. It is a prerequisite for achieving stable and enduring collaboration.

These components function collectively to address specific challenges in Sino-German cooperative education, including cultural barriers, operational disagreements, and organizational differences, while supporting the core goals of collaborative management: sustaining cooperation, improving efficiency, and creating shared educational value.

Collaborative Management in Internationalization of Higher Education Institutions

International university collaborations frequently encounter fundamental conflicts when divergent objectives, cultural differences, and policy constraints undermine shared goals (Soomro et al., 2023; Cai et al., 2020). Structural imbalances in student exchanges further complicate the alignment of disparate higher education systems (Jin &Qi et al., 2023), highlighting an urgent need for governance harmonization (Mustayeva et al., 2022). While existing research has examined interpersonal collaboration (Lee et al., 2020), cross-cultural adaptation (Glass et al., 2022), and institutional management (Ma & Subbiondo, 2022), most studies remain limited to case analyses (Wang et al., 2023) or comparative frameworks (Zhu, 2023).

A Scopus analysis (2019-2024) reveals disproportionate scholarly attention across collaborative management dimensions: knowledge management (184 articles) and conflict resolution (137 articles) dominate research, whereas power distance (6 articles) and cross-cultural competence (11 articles) remain underexplored. Despite over 100 studies investigating knowledge management in collaborative contexts (Wong et al., 2024), few holistically examine the interplay between critical variables—including emotional intelligence, workforce diversity, and trust levels—within international university partnerships. This gap is particularly

pronounced in cross-cultural assessments of collaborative effectiveness and sustainable development metrics for multinational academic teams.

Conceptual Framework and Hypothesis

This study establishes a comprehensive framework for teacher collaborative management in Sino-German educational cooperation at Guizhou Province's HEIs, integrating eight critical latent variables from literature analysis. The framework comprises: (1) Conflict Resolution (CR) - addressing cross-cultural dispute mechanisms; (2) Workforce Diversity (WD) - optimizing heterogeneous team dynamics; (3) Cross-Cultural Competence (CCC) - enhancing intercultural collaboration skills; (4) Emotional Intelligence (EI) - managing interpersonal affect; (5) Social Competence (SC) - fostering mutual understanding; (6) Knowledge Management Competence (KMC) - facilitating organizational learning; (7) Perceived Power Distance (PD) - navigating hierarchical differences; and (8) Trust Level (TL) - strengthening partnership foundations. Each dimension is operationalized through 3-4 measurable indicators, providing a systematic approach to improve team performance and ensure sustainable international cooperation. The model uniquely synthesizes these interrelated factors, emphasizing their collective impact on conflict mitigation and collaborative efficacyin vocational education contexts (see Figure 1).

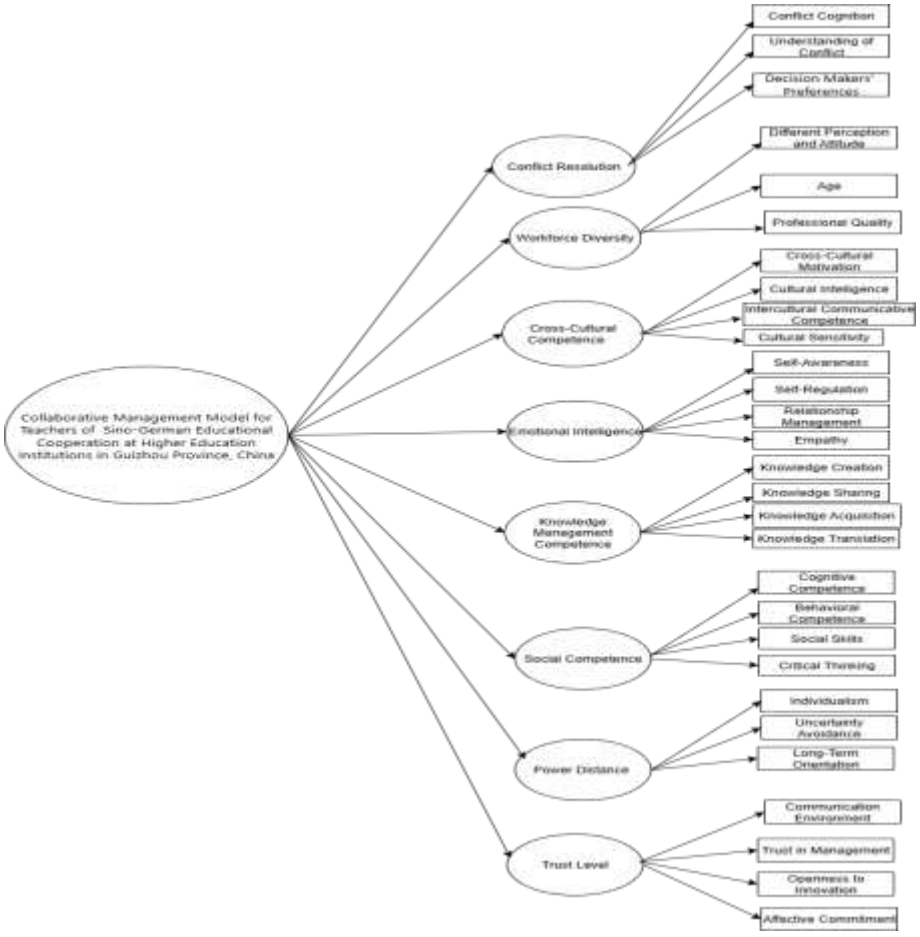


Figure 1. Conceptual Framework

Based on the justifications and framework provided, the following hypotheses are proposed:

H1: Conflict Resolution significantly reflects collaborative management. in Sino-German vocational cooperation at HEIs in Guizhou Province.

H2: Workforce Diversity significantly reflects collaborative management in Sino-German vocational cooperation at HEIs in Guizhou Province.

H3: Cross-Cultural Competence significantly reflects collaborative management in Sino-German vocational cooperation at HEIs in Guizhou Province.

H4: Emotional Intelligence significantly reflects collaborative management in Sino-German vocational cooperation at HEIs in Guizhou Province.

H5: Knowledge Management Competence significantly reflects collaborative management in Sino-German vocational cooperation at HEIs in Guizhou Province.

H6: Social Competence significantly reflects collaborative management in Sino-German vocational cooperation at HEIs in Guizhou Province.

H7: Power Distance significantly reflects collaborative management in Sino-German vocational cooperation at HEIs in Guizhou Province.

H8: Trust Level significantly reflects collaborative management in Sino-German vocational cooperation at HEIs in Guizhou Province.

Research Methodology

This study employs a mixed-methods approach (Creswell & Clark, 2017), integrating confirmatory factor analysis (CFA) and qualitative interviews to examine collaborative management in Sino-German educational cooperation at higher education institutions (HEIs) in Guizhou Province. The target population consists of teachers and administrative staff from 12 HEIs participating in the Sino-German Advanced Vocational Education (SGAVE) project, representing 50% of Guizhou's vocational institutions (China Ministry of Education, 2024).

A stratified sampling strategy was designed with 30 teachers and 12 administrators per institution, yielding a planned sample of 504 respondents. To ensure the target sample size was met, 580 questionnaires were distributed using a 15% oversampling buffer to account for potential invalid responses. Data collection was conducted via China's "Questionnaire Star" platform. A total of 512 valid responses were obtained, resulting in a response rate of 88.3%. The final sample includes four key stakeholder groups: (1) subject teachers in Sino-German programs, (2) language instructors, (3) dual-system teaching supervisors, and (4) international cooperation administrators. This approach ensures representation across all core roles involved in curriculum design, educational management, and cross-cultural collaboration.

To complement the quantitative findings, semi-structured interviews were conducted with nine experts specializing in Sino-German higher education collaboration and vocational

education. The interviews employed a thematic guide aligned with the eight latent variables to explore their relationships with the teacher collaborative management model systematically. Qualitative data were analyzed using a combination of content analysis and thematic analysis techniques. Specifically, interview transcripts were coded using both deductive codes derived from the theoretical framework and inductive codes emerging from the data.

The integration of quantitative and qualitative data followed a connected mixed-methods design. Quantitative results from the CFA established the statistical relationships among the eight latent variables. At the same time, qualitative findings provided nuanced explanations of how these variables manifest in practice and interact within the collaborative management model.

Results and Findings

Research Methodology and Sample Characteristics

This study employs a mixed-methods approach combining confirmatory factor analysis (CFA) and qualitative content analysis to examine collaborative management in Sino-German educational cooperation at higher education institutions (HEIs) in Guizhou Province. The quantitative phase utilized a stratified sampling strategy across 12 HEIs participating in the Sino-German Advanced Vocational Education (SGAVE) project, distributing questionnaires via the "Questionnaire Star" platform. A total of 512 valid responses were obtained, yielding a response rate of 88.3%. The sample consisted of teachers and administrators, with males accounting for 65.8% of respondents—reflecting the gender distribution typical of engineering-dominated programs such as Mechatronics and Vehicle Engineering. Faculty demographics were predominantly aged 30–49 (69% combined), with lecturers comprising the majority (55.9%) and full and associate professors representing 14.8%. The educational background was mainly bachelor's (57.6%) and master's degrees (30.4%). Administrative staff included teaching administrators (12.5%) and international affairs officers (10.4%). See Table 1.

Table 1: Demographic Data of the Respondents

	Personal status of the respondent	**Quantity (n = 512)**	**percentage**
1. Gender	male	337	65.8
	female	175	34.2
2. Age	25-29 years	24	5
	25-29 years	58	11
	30-39 years	189	37
	40-49 years	164	32
	Above 50 years	77	15
3. Educational Background	Bachelor's degree	295	57.6
	Master's degree	155	30.4
	Doctoral degree	25	4.8
	College diploma	37	7.2
4. Working Experience	under 5 years	92	18
	5-10 years	168	32.8
	11-15 years	144	28.1
	16-20 years	61	12
Position	Professor, Assistant professor	76	14.8
	Lecturer	286	55.9
	Student supervisor	33	6.4
	Teaching administrator	64	12.5
	International affairs administrator	53	10.4
Overseas study experience	Bachelor's degree	7	1.4
	Master's degree	56	10.9
	Doctoral degree	8	1.6
	Overseas visiting sholar	62	12.1
	No overseas experience	379	74
Total		**512**	**100**

Descriptive Statistics for Latent Variables

The descriptive statistics indicate that all variables, measured on a 5-point Likert scale, demonstrate moderate agreement (means: 3.40–3.55) with acceptable dispersion (SDs: 0.71–0.79). Negative skewness (-0.50 to -0.754) and platykurtic distributions (kurtosis: -0.78 to

-0.32) suggest slight left-tailed but generally normal distributions, supporting parametric analyses. Notably, Emotional Intelligence shows the lowest mean (3.40) and highest variability (SD=0.79), while Power Distance exhibits the most consensus (mean=3.55, SD=0.71). See Table 2.

Table 2: Descriptive Statistics Analysis

Variables	Mean	S.D.	Skewness	Kurtosis
Conflict Resolution	3.53	0.73	-0.64	-0.50
Workforce Diversity	3.53	0.72	-0.62	-0.47
Cross-Cultural Competence	3.46	0.74	-0.51	-0.78
Emotional Intelligence	3.40	0.79	-0.65	-0.56
Knowledge Management Competence	3.50	0.75	-0.55	-0.74
Social Competence	3.47	0.77	-0.75	-0.32
Power Distance	3.55	0.71	-0.72	-0.33
Trust Level	3.46	0.76	-0.72	-0.36

Confirmatory Factor Analysis and Hypothesis Testing

First -order Factor Analysis

Table 3 presents the correlation coefficients between latent variables. The values range as follows: between TL and PD, it is 0.72; between TL and SC, 0.57; between TL and KM, 0.53; between TL and EI, 0.51; between TL and CC, 0.41; between TL and WD, 0.49; between TL and CR, 0.53; between PD and SC, 0.71; between PD and KM, 0.55; between PD and EI, 0.41; between PD and CC, 0.36; between PD and WD, 0.51; between PD and CR, 0.52; between SC and KM, 0.70; between SC and EI, 0.48; between SC and CC, 0.43; between SC and WD, 0.49; between SC and CR, 0.48; between KM and EI, 0.62; between KM and CC, 0.47; between KM and WD, 0.44; between KM and CR, 0.52; between EI and CC, 0.64; between EI and WD, 0.52; between EI and CR, 0.45; between CC and WD, 0.67; between CC and CR, 0.56; and between WD and CR, 0.68. These coefficients measure the linear relationships between the latent variables.

Table 3: Correlation Coefficient between Latent Variables

	TL	PD	SC	KM	EI	CC	WD	CR
TL	1							
PD	0.72	1						
SC	0.57	0.71	1					
KM	0.53	0.55	0.70	1				
EI	0.51	0.41	0.48	0.62	1			
CC	0.41	0.36	0.43	0.47	0.64	1		
WD	0.49	0.51	0.49	0.44	0.52	0.67	1	
CR	0.53	0.52	0.48	0.52	0.45	0.56	0.68	1

The multiple-variable confirmatory factor analysis demonstrated good model fit as indicated by the following indices: Chi-Square/df = 1.647; p-value < 0.001; GFI = 0.918; AGFI = 0.903; TLI = 0.91; CFI = 0.92; RMR = 0.066; RMSEA = 0.036. See Figure 2.

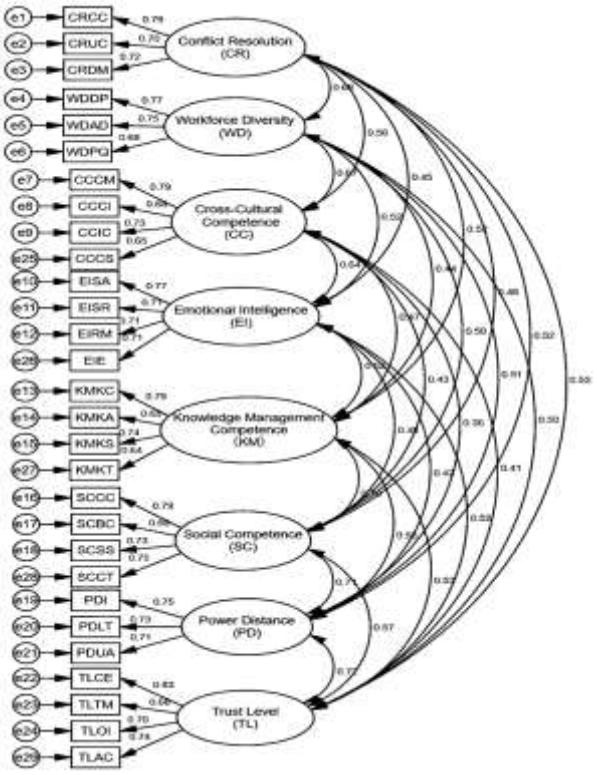


Figure 2: Multiple-Variable Confirmatory Factor Analysis Results

Second-order CFA Results

As shown in Figure 3, multiple-variable confirmatory factor analysis identified the components and their factor loadings for each construct: Conflict Resolution (CR) includes CRCC (0.77), CRUC (0.76), and CRDM (0.72); Workforce Diversity (WD) includes WDDP (0.73), WDAD (0.78), and WDPQ (0.66); Cross-Cultural Competence (CC) includes CCCM (0.76), CCCI

(0.67), CCIC (0.65), and CCCS (0.63); Emotional Intelligence (EI) includes EISA (0.76), EISR (0.69), EIRM (0.68), and EIE (0.74); Knowledge Management Competence (KM) includes KMKC (0.77), KMKA (0.72), KMKS (0.63), and KMKT (0.63); Social Competence (SC) includes SCCC (0.77), SCBC (0.64), SCSS (0.73), and SCCT (0.74); Power Distance (PD) includes PDI (0.74), PDLT (0.72), and PDUA (0.69); and Trust Level (TL) includes TLCE (0.82), TLTM (0.66), TLOI (0.69, and TLAC (0.74). The analysis demonstrated good model fit with the following indices: Chi-Square/df = 1.647; $p < 0.001$; GFI = 0.918; AGFI = 0.903; TLI = 0.91; CFI = 0.92; RMR = 0.066; RMSEA = 0.036. See Figure 3.

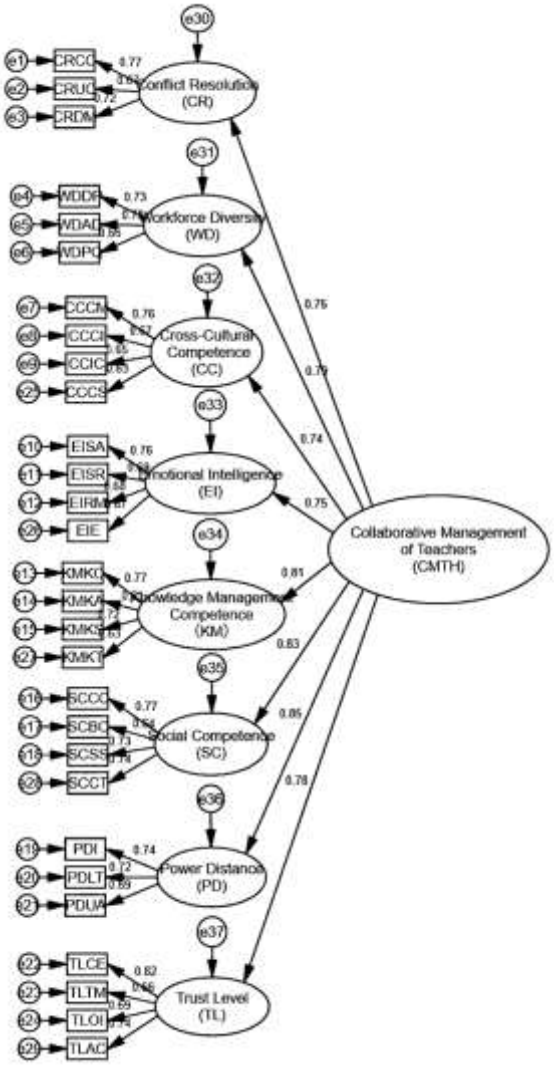


Figure 3: Second-order Confirmatory Factor Analysis Results

Validity and Reliability Statistics

Table 4 reports the reliability and discriminant validity results for variables including Conflict Resolution, Workforce Diversity, etc. Cronbach's **α** coefficients are high (0.900 - 0.922), reasonably so, as each latent variable has 12 - 16 items due to its multi-manifest variable composition with 3-4 items per manifest variable, and a significant item number can

raise α even with moderate inter-item correlations. Composite reliability (CR) values, from 0.87 (PD) to 0.92 (EI) and mainly in the 0.7 - 0.9 range, indicate strong reliability. Average variance extracted (AVE) values, exceeding 0.5 (0.64 - 0.74), show satisfactory convergent validity, while discriminant validity is evidenced by MSV and ASV values being lower than AVE values for all variables. Alpha values retain three decimal places instead of APA-format two for better distinction given their similarity, and overall, the study's measurement model exhibits good reliability and validity.

Table 4: Reliability and Discriminant Validity

Variable	Cronbach's α*	CR	AVE	MSV	ASV
Conflict Resolution (CR)					
Workforce Diversity (WD)	0.902	0.89	0.68	0.44	0.34
Cross-Cultural Competence	0.901	0.88	0.66	0.43	0.33
(CC)	0.910	0.90	0.69	0.44	0.34
Emotional Intelligence (EI)	0.920	0.92	0.74	0.48	0.37
Knowledge Management	0.916	0.90	0.70	0.45	0.35
Competence (KM)	0.921	0.91	0.73	0.46	0.36
Social Competence (SC)	0.900	0.87	0.64	0.42	0.32
Power Distance (PD)	0.920	0.91	0.71	0.45	0.35
Trust Level (TL)					

* The alpha values here are similar, retaining three decimal places instead of the APA format's two decimal places.

Table 5: Hypothesis Testing

Testing	Standardized Coefficient (β)	S.E.	C.R.	P
Conflict Resolution (CR) Collaborative Management of Teachers (CMTH)	0.75	0.10	9.77	***
Workforce Diversity (WD) Collaborative Management of Teachers (CMTH)	0.79	0.10	10.024	***
Cross-Cultural Competence (CC) Collaborative Management of Teachers (CMTH)	0.74	0.10	9.67	***
Emotional Intelligence (EI) Collaborative Management of Teachers (CMTH)	0.75	0.10	9.56	***

Testing	Standardized Coefficient (β)	S.E.	C.R.	P
Knowledge Management Competence(KM) Collaborative Management of Teachers (CMTH)	0.81	0.11	9.73	***
Social Competence (SC) Collaborative Management of Teachers (CMTH)	0.83	0.11	10.08	***
Power Distance (PD) Collaborative Management of Teachers (CMTH)	0.85	0.11	9.99	***
Trust Level (TL) Collaborative Management of Teachers (CMTH)	0.78	0.11	10.43	***

Note:*** $p < 0.001$.

As depicted in Table 5, an analysis of the relationships between various factors and Collaborative Management of Teachers (CMTH) was conducted. Conflict Resolution (CR) demonstrates a standardized coefficient of 0.75 and a P-value less than 0.001, indicating a robust and significant positive impact on CMTH, which validates the corresponding hypothesis.

Similarly, Workforce Diversity (WD) shows a standardized coefficient of 0.79 with a P-value less than 0.001, strongly influencing CMTH and confirming the related hypothesis. Cross-cultural Competence (CC) has a standardized coefficient of 0.74 and a P-value below 0.001, which also significantly positively affects CMTH, making the hypothesis hold. Emotional Intelligence (EI) presents a standardized coefficient of 0.75 and a P-value less than 0.001, strongly affecting CMTH and supporting the hypothesis.

All coefficients were rounded to two decimal places for presentation. Statistical significance was determined using full-precision estimates. Bootstrapped confidence intervals (CIs) were computed to evaluate coefficient stability, with non-overlapping CIs indicating statistically distinct effects (Preacher & Hayes, 2008)

Knowledge Management Competence (KM) has a standardized coefficient of 0.81 with a P-value less than 0.001, exerting a strong positive influence on CMTH and validating the corresponding hypothesis. Social Competence (SC) shows a standardized coefficient of 0.83 and a P-value less than 0.001, significantly impacting CMTH and establishing the hypothesis. Power Distance (PD) has a standardized coefficient of 0.85 and a p-value less than 0.001, strongly affecting CMTH and confirming the hypothesis. Finally, Trust Level (TL) has a standardized coefficient of 0.78 and a P-value less than 0.001, strongly influencing CMTH and supporting the hypothesis. All these factors significantly and positively contribute to CMTH, providing strong evidence for the formulated hypotheses.

Table 6: Model Comparison: First-order and Second-order CFA

Model Type	χ^2/df	GFI	AGFI	CFI	TLI	RMSEA	SRMR
First-order CFA Model	1.34	0.96	0.92	0.92	0.91	0.04	0.042
Second-order CFA Model	1.65	0.92	0.90	0.92	0.91	0.04	0.03

Table 6 shows both first-order (χ^2/df=1.34, GFI=0.96, SRMR=0.042) and second-order CFA (χ^2/df=1.65, GFI=0.92, SRMR=0.03) demonstrate acceptable fit, with CFI/TLI=0.92/0.91 and RMSEA=0.04 for both. While the first-order model shows slightly better absolute fit, the second-order model's superior SRMR and theoretical parsimony may justify its preference despite higher χ^2/df. Model selection should balance statistical and theoretical considerations.

Table 7: Model Fit Index

Fit Index	Threshold
χ^2/df	<3 (lenient <5)
CFI	≥0.90 (≥0.95)
TLI (NNFI)	≥0.90 (≥0.95)
RMSEA	<0.05 good; 0.05-0.10 moderate; >0.10 bad
SRMR	<0.09
p-values	>0.5

Notes: Reliability: CR>0.7; convergent validity: AVE>0.5; discriminant validity: MSA, ASV<AVE.
Source: Hair et al. (2010).

Based on the threshold values in Table 7, for the second-order CFA model, the χ^2/df value of 1.65 is within the lenient threshold of less than 5 and meets the stricter criterion of less than 3. The CFI and TLI values of 0.92 and 0.91, respectively, are above the minimum requirement of 0.90. The RMSEA value of 0.04 is in the good range (less than 0.05), and the SRMR value of 0.03 is below the 0.09 threshold. These fit indices suggest that the second-order CFA model is acceptable to the data, indicating a reasonable representation of the relationships among the studied constructs.

Qualitative Data Analysis

The qualitative analysis adopted a grounded theory approach (Glaser & Strauss, 1967), utilizing semi-structured interviews with nine interdisciplinary experts—including German educational administrators, Sino-German project leaders, and international education researchers—to explore cultural frictions, collaborative bottlenecks, and adaptive strategies in Sino-German higher education cooperation. The coding process followed three stages: open coding extracted initial concepts; axial coding categorized these into themes aligned with the study's eight latent variables and selective coding integrated these into core thematic constructs . Thematic analysis was supported using NVivo, including word frequency analysis and semantic sentiment analysis, which revealed predominantly neutral and fact-based responses. Expert validation confirmed the credibility of the coded themes, such as German preferences for institutional trust versus Chinese relational trust, and clashes between flat and hierarchical management styles, ensuring that qualitative findings effectively complemented quantitative CFA results and collectively validated the role of the eight latent variables in shaping teacher collaborative management capabilities.

Ethical Consideration

This study strictly adheres to academic ethical standards. Before to the initiation of the research, the research protocol and related materials were submitted to the Ethics Committee of Suan Sunandha Rajabhat University for review. This ethical review application was categorized as an initial review, aiming to ensure that the entire research process complies with ethical and moral standards.

Conclusion

This study develops a contextually adaptive collaborative management model for teachers in Sino-German vocational education cooperation at Guizhou's higher education institutions (HEIs), centered on eight core latent variables: Conflict Resolution, Workforce Diversity, Cross-Cultural Competence, Emotional Intelligence, Social Competence, Knowledge Management Competence, Power Distance, and Trust Level. Using a mixed-methods design—including surveys of 512 valid respondents from 12 Guizhou HEIs with Sino-German cooperation programs, in-depth interviews with nine interdisciplinary experts, and confirmatory factor analysis (CFA)—the research confirms all eight variables exert a significant positive impact on teachers' collaborative management capability, with standardized coefficients ranging from 0.74 to 0.85 (all $p < 0.001$). Both first-order and second-order CFA models show excellent fit, with indicators including CFI = 0.92, RMSEA = 0.026–0.040, and χ^2/df = 1.265–1.647, validating the framework's structural robustness and psychometric reliability (Cronbach's α = 0.900–0.922, Composite Reliability = 0.87–0.928, Average Variance Extracted = 0.587–0.640).

Findings highlight Guizhou-specific challenges: 74% of surveyed teachers (including administrators) lack overseas experience, leading to gaps in Cross-Cultural Competence and Emotional Intelligence (notably relationship management); Power Distance emerges as the strongest predictor of collaborative management capability, reflecting tensions between Germany's low-power-distance, flat hierarchical culture and Guizhou HEIs' top-down administrative structures. The model integrates German systematic management paradigms with Chinese contextual flexibility to address Guizhou's late-stage internationalization and vocational education needs, providing an actionable tool to enhance the sustainability of Sino-German educational cooperation in developing regions.

Recommend

For Guizhou HEIs, strengthen targeted cross-cultural training by developing Guizhou-specific modules integrating local ethnic minority cultural contexts into intercultural education and complementing formal training with intercultural debriefing sessions post-joint classes for teachers to reflect on cultural missteps and co-develop adaptive strategies, prioritize Emotional Intelligence development by launching emotional alignment programs with monthly check-in sessions for joint teams to discuss emotional triggers and training cultural emotion mediators to resolve emotional misalignments, and establish hybrid knowledge management platforms by building integrated systems combining formal databases and informal sharing channels and assigning KM champions to track knowledge translation and ensure equitable resource access; for Sino-German cooperative projects, design transparent, tiered decision-making mechanisms by adopting a dual-track leadership model and implementing a two-stage consultation process for key decisions (collecting input from all teachers first, then finalizing with institutional leaders) and enhance Trust Level through culturally adaptive interactions by combining transparent processes with relationship-nurturing activities to address cultural gaps in trust-building; for policymakers, support regional capacity building by allocating targeted funding to expand faculty exchange programs and upgrade digital collaboration infrastructure and promote systemic alignment by facilitating dialogue between Chinese and German regulatory bodies to harmonize qualification standards and streamline administrative procedures; for future research, explore longitudinal impacts of the model by conducting a 2-3 year follow-up study on Guizhou HEIs to track variable changes and their correlation with collaborative outcomes, expand regional and stakeholder comparisons by replicating the research in other regions and including student and enterprise perspectives, and conduct critical analysis of underperforming variables by investigating cultural and institutional drivers of low Emotional Intelligence scores and why Power Distance exerts a pronounced influence in Sino-German cooperation.

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